IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF LOUISIANA
LAFAYETTE-OPELOUSAS DIVISION

UNITED STATES OF AMERICA, and STATE OF LOUISIANA,	§	
Plaintiffs,	§	
v.	§	**CIVIL ACTION NO. 6:04CV1351**
	§	**JUDGE REBECCA F. DOHERTY**
	§	**MAGISTRATE JUDGE C. MICHAEL**
TY OF NEW IBERIA,	§	**HILL**
Defendant.	§	

FINAL JUDGMENT

Upon approval and entry of the Consent Decree among the United States of America ("United States"), the State of Louisiana ("State"), and the City of New Iberia ("City") by the Court, the Consent Decree shall constitute a settlement of the claims alleged and final judgment between the United States, the State of Louisiana, and the City.

ACCORDINGLY, the Court finds that there is no just reason for delay and therefore enters this judgment as a FINAL JUDGMENT under Federal Rules of Civil Procedure 54 and 58, and it is

FURTHER ORDERED that the claims asserted by the United States and the State in their Complaint against the City be and hereby are dismissed, and it is

FURTHER ORDERED that the Court shall retain jurisdiction of this case until termination of the Consent Decree for the purpose of enabling any of the parties to apply to the Court for such further order, direction, or relief as may be necessary or appropriate for the construction or modification of the Consent Decree, or to effectuate or enforce compliance with its terms, or to resolve disputes in accordance with Section XV of the Consent Decree (Dispute

Resolution).

Dated and entered this 26 Day of October, 2005.

REBECCA F. DOHERTY
UNITED STATES DISTRICT JUDGE

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF LOUISIANA

UNITED STATES OF AMERICA and STATE OF LOUISIANA,	)	CIVIL ACTION NO. 6:04CV1351
Plaintiffs,	)	JUDGE REBECCA F. DOHERTY
v.	)	MAGISTRATE JUDGE C. MICHAEL HILL
CITY OF NEW IBERIA	)	
Defendant.	)	

CONSENT DECREE

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WHEREAS, Plaintiff, the United States of America ("United States"), by the authority of the Attorney General of the United States and through its undersigned counsel, acting at the request and on behalf of the Administrator of the United States Environmental Protection Agency ("EPA") has filed a Complaint in this action seeking injunctive relief and civil penalties pursuant to Section 309 of the Clean Water Act, 33 U.S.C. § 1319, naming as defendant the City of New Iberia (the "City") pursuant to Section 309(e) of the Clean Water Act, 33 U.S.C. § 1319(e);

WHEREAS, Plaintiff, the State of Louisiana, on behalf of the Louisiana Department of the Environmental Quality ("LDEQ"), has joined in the Complaint against the City for its alleged violations of the Clean Water Act, and the Louisiana Environmental Quality Act, LSA-R.S. 30:2001, et seq.;

WHEREAS, the City owns and operates a publicly owned treatment works ("POTW") commonly known as the Admiral Doyle Wastewater Treatment Plant located in New Iberia, Louisiana that treats and discharges domestic and commercial sewage from the City and adjacent unincorporated areas via the Sewerage District;

WHEREAS, the City and the Sewerage District jointly own and operate a publicly owned treatment works ("POTW") commonly known as the Tete Bayou (or Parker Street) Wastewater Treatment Plant located in Iberia Parish, Louisiana that serves the citizens of New Iberia and Iberia Parish;

WHEREAS, the Plaintiffs allege that the City has violated and continues to violate Section 301 of the Clean Water Act, 33 U.S.C. § 1311, by discharging untreated sewage from its sanitary sewer collection system and pollutants in excess of effluent limitations into the Commercial Canal and Tete Bayou and thence into Vermilion Bay of the Vermilion Teche Basin,

which are Waters of the United States. In addition, the Plaintiffs allege that the City has violated and is violating other conditions established in the National Pollutant Discharge Elimination System ("NPDES") Permit Nos. LA0044008 issued to the City and Permit No. LA0065251 issued to the City and the Sewerage District pursuant to Section 402 of the Act, 33 U.S.C. § 1342;

WHEREAS, without making any admission of law or fact, and without admitting any violation of any law or regulation, the Parties have negotiated in good faith and have reached a settlement of the issues raised in the Complaint;

WHEREAS, the Parties agree, and the Court finds, that settlement of the claims alleged in the Complaint without further litigation or trial of any issues is fair, reasonable, and in the public interest and that the entry of this Consent Decree is the most appropriate way of resolving the claims alleged in the Complaint;

NOW THEREFORE, it is hereby ORDERED, ADJUDGED and DECREED as follows:

I. JURISDICTION AND VENUE

1. This Court has jurisdiction over the subject matter of this action pursuant to 28 U.S.C. §§ 1331, 1345, and 1355, and Section 309 of the Clean Water Act, 33 U.S.C. § 1319, and 28 U.S.C. §§ 1331, 1345, 1355, and 1367. Venue lies in this District pursuant to Section 309 of the Clean Water Act, 33 U.S.C. § 1319, and 28 U.S.C. § 1391 because the City is a political subdivision of the State of Louisiana and is located in this judicial district. For purposes of this Consent Decree, or any action to enforce this Consent Decree, the City consents to the Court's jurisdiction over this Consent Decree or such action and over the City, and consents to venue in this judicial district.

2. For purposes of this Consent Decree, the City agrees that the Complaint states claims upon which relief may be granted pursuant to Sections 301 and 309 of the Clean Water Act, 33 U.S.C. §§ 1311 and 1319, for injunctive relief and civil penalties.

3. Notice of the commencement of this action has been given to the State of Louisiana, as required by Section 309(b) of the Clean Water Act, 28 U.S.C. § 1319(b).

II. PARTIES

4. Plaintiff, the United States, is acting at the request and on behalf of the Administrator of the United States Environmental Protection Agency. Plaintiff, the State of Louisiana is a person within the meaning of Sections 502(5) and 505 of the Clean Water Act, 33 U.S.C. §§ 1362(5) and 1367.

5. The defendant, the City of New Iberia, is a political subdivision created by the State of Louisiana, and a municipality within the meaning of Section 502(4) of the Clean Water Act, 33 U.S.C. § 1362(4).

III. APPLICABILITY

6. The obligations of this Consent Decree apply to and are binding on the United States and the State; and upon the City, its agents, successors, and assigns.

7. Any transfer of ownership or operation of the Admiral Doyle Wastewater Treatment Plant, the new Wastewater Treatment Plant presently under construction, or the Tete Bayou (Parker Street) Wastewater Treatment Plant and/or the sewage collection systems owned or operated by the City for those plants, to any other person must be conditioned upon the transferee's agreement to undertake the obligations required by this Consent Decree, as provided in a written agreement between the City and the proposed transferee, enforceable by the United

States and the State as third-party beneficiaries of such agreement. At least thirty (30) days prior to such transfer, the City shall provide a copy of this Consent Decree to the proposed transferee and shall simultaneously provide written notice of the prospective transfer, together with a copy of the proposed written agreement, to EPA Region VI, the United States Attorney for the Western District of Louisiana, and the United States Department of Justice, in accordance with Section XIX of this Consent Decree (Notices). Any attempt to transfer ownership or operation of the above facilities without complying with this Paragraph constitutes a violation of this Consent Decree. No transfer of ownership or operation of the above facilities, whether in compliance with this Paragraph or otherwise, shall relieve the City of its obligation to ensure that the terms of this Consent Decree are implemented.

8. The City shall provide a copy of relevant portions of this Consent Decree to all officers, supervisory employees, and agents whose duties might reasonably include compliance with any provision of this Consent Decree, as well as to any independent contractor retained to perform work required under this Consent Decree. The City shall condition any such contract upon performance of the work in conformity with the terms of this Consent Decree.

9. In any action to enforce this Consent Decree, the City shall not raise as a defense the failure by any of its officers, directors, employees, agents, or contractors to take any actions necessary to comply with the provisions of this Consent Decree.

IV. PURPOSE

10. The express purpose of the Parties entering into this Consent Decree is to take all measures necessary to enable the City to comply with the Clean Water Act, the regulations promulgated thereunder, and the terms of applicable NPDES permits, with the goal of

eliminating sanitary sewer overflows and discharges of pollutants in excess of effluent limitations.

V. DEFINITIONS

11. Terms used in this Consent Decree that are defined in the Clean Water Act ("CWA") or in regulations promulgated pursuant to the CWA shall have the meanings assigned to them in the CWA or such regulations, unless otherwise provided in this Consent Decree. Whenever the terms set forth below are used in this Consent Decree, the following definitions shall apply:

- "The Admiral Doyle Wastewater Treatment Plant" means the publicly owned treatment works, including its collection system, owned and operated by the City of New Iberia, Louisiana (referred to hereinafter as the Admiral Doyle Plant).
- "BOD" means biochemical oxygen demand.
- "Calendar quarter" means a three-month period ending on March 31st, June 30th, September 30th, or December 31st.
- "City" means the City of New Iberia, Louisiana.
- "Collection System" means the sanitary sewage collection and transmission system (including all pipes, force mains, gravity sewer lines, lift stations, pump stations, manholes, and appurtenances thereto) owned or operated by the City that serve the Admiral Doyle, Tete Bayou, and/or New Plants.
- "Consent Decree" means this Decree, all appendices and exhibits to this Decree, and all required submittals approved by EPA and LDEQ pursuant to Section XIII (Review of Submittals). In the event of any conflict between this Decree and any attachment, exhibit, or approved item, this Decree shall control.
- "Cross Connection" shall mean any physical connection of piping or other facilities or equipment between the Drainage System and the Collection System which allows stormwater or other waters (except sanitary sewage and industrial wastewaters) to flow into the Collection System.
- "CWA" means the Clean Water Act, 33 U .S.C. §§ 1251 et seq.
- "Date of Lodging" means the date this Consent Decree is received by the Clerk of the United States District Court for the Western District of Louisiana prior to signature by the District Judge assigned to this civil action.

- "Date of Entry" means the date this Consent Decree is filed by the Clerk of the United States District Court for the Western District of Louisiana after being signed by the District Judge assigned to this civil action.

- "Day" shall mean a calendar day unless expressly stated to be a working day. In computing any period of time under this Consent Decree, where the last day would fall on a Saturday, Sunday, or State or federal holiday, the period shall run until the close of business of the next working day.

- "The defendant" means the City of New Iberia, Louisiana.

- "Drainage System" shall mean pipes, conduits, channels, stormwater pump stations, canals and other appurtenances designed for and used for conveying stormwater runoff, surface water runoff, and other drainage water.

- "Effective Date of this Consent Decree" means the Date of Entry.

- "EPA" means the United States Environmental Protection Agency and any successor departments or agencies of the United States.

- "Force main" shall mean any pipe that receives and conveys wastewater from the discharge side of a pump. A force main is intended to convey wastewater under pressure.

- "Infiltration and Inflow" or "I & I" means the infiltration of groundwater and the inflow of stormwater into the Admiral Doyle Plant, Tete Bayou Plant, and New Plant Collection Systems.

- "Gravity sewer line" shall mean a pipe that receives, contains and conveys wastewater not normally under pressure, but is intended to flow unassisted under the influence of gravity. Gravity sewers are not intended to flow full under normal operating conditions.

- "LDEQ" means the Louisiana Department of Environmental Quality.

- "New Plant" means the treatment facility that is being constructed at the recently acquired 150-acre site between LA Highway 675 and LA Highway 14 near the southwest entrance to the City of New Iberia, Louisiana.

- "Non-Compliant Discharge" means any discharge of wastewater through an outfall from which the City and/or the Sewage District is permitted to discharge pursuant to NPDES Permit Nos. LA0044008 and LA0065251 which is not in compliance with requirements and conditions specified in those permits or in the Interim Effluent Limitations (Section XI) established herein.

- "NPDES Permit No LA0044008" means National Pollutant Discharge Elimination System ("NPDES") permit number LA0044008 issued pursuant to CWA Section 402, 33 U.S.C. § 1342, for the Admiral Doyle Plant and any future, extended, modified, or reissued NPDES permit for the same facility.

- "NPDES Permit No LA0065251" means National Pollutant Discharge Elimination System ("NPDES") permit number LA0065251 issued pursuant to CWA Section 402, 33 U.S.C. § 1342, for the Tete Bayou Plant and any future, extended, modified, or reissued NPDES permit for the same facility.

- "Paragraph" means a portion of this Consent Decree identified by an Arabic numeral.

- "Parish" means the Parish of Iberia, Louisiana.

- "Public property SSO" means any SSO that is the direct result of a blockage, collapse, hydraulic overload, or other failure occurring in a City-owned sewer line.

- "Sanitary Sewer" has the same meaning as Collection System.

- "Sanitary Sewer Overflow" or "SSO" shall mean an overflow, spill, diversion, or release of wastewater from or caused by the City's Collection System, except that the term "SSO" does not include wastewater backups into buildings or onto private property caused by a private illegal connection or by a blockage or other malfunction in a service lateral that is privately owned.

- "SSO Subject to Stipulated Penalties" or "Subject SSO" shall mean (i) a SSO that results in a release to navigable waters or surface waters of the State in excess of 500 gallons, and (ii) any other SSO in excess of 1000 gallons. A "Subject SSO" shall not include a discharge on private property resulting from an illegal private connection.

- "Section" means a portion of this Consent Decree identified by uppercase Roman numerals.

- "Sewerage District" means Sewerage District No. 1 of Iberia Parish, Louisiana.

- "Sewershed" means any drainage area contributing flow to the Collection System owned or operated by the City of New Iberia.

- "State" means the State of Louisiana.

- "Start of Construction" means issuance by the City of a notice to proceed with construction to the contractor performing the relevant construction project.

- "Subparagraph" means a portion of a Paragraph.

- "The Tete Bayou Wastewater Treatment Plant" means the publicly owned treatment works, including its collection system, located on Parker Street approximately 3.5 miles east of the City of New Iberia, Iberia Parish, Louisiana, jointly owned and operated by the City and the Sewerage District (referred to hereinafter as the Tete Bayou Plant).

- "TSS" means total suspended solids.

VI. COMPLIANCE WITH CLEAN WATER ACT

12. The City shall comply at all times with the CWA, the regulations promulgated thereunder, the Louisiana Environmental Quality Act, the regulations promulgated thereunder, and all terms of applicable NPDES permits, except as otherwise provided in Section XI (Interim Effluent Limitations).

VII. REMEDIAL MEASURES

A. Remedial Measures for Wastewater Treatment Plants

13. **Construction of a New Wastewater Treatment Facility:** In order to assist in achieving compliance with its obligations under the CWA, the regulations promulgated thereunder, and applicable NPDES permits, the City has agreed to construct, and is constructing, a new wastewater treatment facility ("New Plant"), as described in Appendix A and the City's Facility Update Plan and in accordance with the following schedule.

Unless extended by the provisions of Paragraph 14, below, milestones for construction of the wastewater treatment plant are as follows:

(a) By no later than April 1, 2006, the City shall complete construction of the New Plant;

(b) By no later than June 2007, the City shall complete construction of the pump station/force main; and

(c) By no later than December 30, 2007, the City shall complete the transfer of wastewater flow from the Admiral Doyle Plant.

(d) All operators at the New Plant shall be trained and shall be certified in accordance with State law.

14. Nothing in this Consent Decree shall prohibit the City from seeking an adjustment in the above schedule if more stringent NPDES limits are imposed for the New Plant than the limits currently in effect under NPDES Permit No. LA0044008.

15. **Construction of an Equalization Basin at the Tete Bayou Plant**: In a separate Consent Decree, the Sewerage District is required to apply for any necessary permit(s) for the construction of an equalization basin at the Tete Bayou Plant to relieve wet weather plant hydraulic overload conditions and to submit a schedule for completion of the project to EPA and LDEQ and begin construction of the equalization basin within one hundred eighty (180) days after obtaining the necessary permit(s). The cost associated with the construction, operation and maintenance of the Equalization Basin shall be shared by the City and the Sewerage District.

16. **Sewage Sludge Management:** In order to fully comply with the sewage sludge management requirements set forth in the applicable NPDES permits, the City shall:

A. Within thirty (30) days after the Date of Entry of this Consent Decree, (i) operate and maintain the Mobile Belt Filter press and Lime Stabilization Facility located at the Tete Bayou Plant in a manner that prevents any stockpiled sludge from contaminating storm water or other waters of the United States, or (ii) construct a permanent containment area with an underflow or runoff collection system for any stockpiles of sludge or stabilized biosolids awaiting land application;

B. Before completion of the New Plant, (i) purchase another Mobile Belt Filter press or similar technology, or (ii) construct a permanent containment area with an underflow or runoff

collection system for any stockpiles of sludge or stabilized biosolids awaiting land application to manage sewage sludge to be generated at the New Plant; and

C. Upon Date of Entry of this Consent Decree, the City shall not stockpile sludge or stabilized biosolids outside of the permitted containment area located at the Tete Bayou Plant or outside of any other permitted containment area location selected by the City. Nothing in this Consent Decree shall prevent the City from negotiating appropriate cost sharing of sewage sludge management with the Sewerage District.

B. Remedial Measures for Elimination of Sanitary Sewer Overflows: The City shall eliminate Sanitary Sewer Overflows ("SSOs") originating from the City-owned Collection System through development and implementation of the measures set forth in Paragraphs 17 through 23, below, and any other necessary measures.

17. **SSO Characterization Report**: No later than one hundred eighty (180) days after the Date of Entry of this Consent Decree, the City shall submit to EPA and LDEQ for review a SSO Characterization Report that includes:

i. An updated map that depicts the Collection System and all of its appurtenances as described below. The map shall depict the locations of all known outfalls, regulators, manholes, and Pump Stations;

ii. Identification of the sewersheds that contribute flow to the City's Collection System;

iii. Identification (where available) of the frequency, date, duration, and volume (measured durations and volumes where available, or best estimates) of known SSOs (on a per event basis) during the five (5) years preceding the Date of Entry of the Consent Decree;

iv. The magnitude of rainfall events which have typically resulted in overflows for each known SSO location where there have been three (3) or more overflow events during the five (5) years preceding the Date of Entry of the Consent Decree;

v. Identification of any cause or condition that contributed to each known SSO (if known); and

vi. Identification of any projects already undertaken and/or completed to correct existing known SSOs, and the effectiveness of such projects.

vii. Identification of any projects to be undertaken to correct existing known SSOs, including a schedule for completion for each project.

Notwithstanding the foregoing, within forty-five (45) days after the Date of Entry of this Consent Decree, the City shall determine and submit to EPA and LDEQ for review a high priority SSO Characterization Report for areas of the Collection System that substantially contribute to SSOs and that are not expected to be significantly impacted by the transfer of wastewater flow from the Admiral Doyle Plant to the New Plant. The high priority SSO areas may include but may not be limited to the following areas of the Collection System:

i. Areas of the Collection System that directly contribute to the SSOs occurring at or near the intersection of Monterey Street and Santa Clara Street;

ii. Areas of the Collection System that directly contribute to the SSOs occurring at or near the D-7 pump station on Landry Drive; and

iii. Areas of the Collection System that directly contribute to the SSOs occurring at or near the intersection of Duperier Avenue and Nita Street.

18. **Collection System Evaluation and Sewershed Study Plans:** Within sixty (60) days after submittal of the SSO Characterization Report (Paragraph 17), the City shall propose to EPA and LDEQ a comprehensive plan to study each sewershed in the Collection System ("Sewershed Study Plan"). As specified in this Paragraph, the Sewershed Study Plan shall include schedules and the procedures set forth in Subparagraphs A, B, and C, below. After EPA and LDEQ have approved the Sewershed Study Plan, the City shall begin implementation of the Sewershed Study Plan in accordance with the schedules set forth therein. The City may submit a request to plaintiffs for approval to waive the requirement to study one or more sewersheds. If the City is required to submit a sewershed study plan, the City may use all relevant data previously collected, and must also include any recent data collected, as part of that submittal. Notwithstanding the foregoing, within sixty (60) days after submittal of the high priority SSO Characterization Report, referred to in Paragraph 17, the City shall propose to EPA and LDEQ for approval a focused plan to study the areas of the Collection System that most contribute to SSOs identified in the high priority SSO Characterization Report and that are not expected to be significantly impacted by the transfer of wastewater flow from the Admiral Doyle Plant to the New Plant. These areas included in the focused Study Plan may include but may not be limited to:

i. Areas of the Collection System that directly contribute to the SSOs occurring at or near the intersection of Monterey Street and Santa Clara Street;

ii. Areas of the Collection System that directly contribute to the SSOs occurring at or near the D-7 pump station on Landry Drive; and

iii. Areas of the Collection System that directly contribute to the SSOs occurring at or near the intersection of Duperier Avenue and Nita Street.

A. **Collection System Inspections**:

i. **Scope and Nature of Inspections:** As part of each sewershed study, the City shall complete the inspection of:

a. all gravity lines having a diameter of eight (8) inches or greater by smoke and/or dye testing and television inspection as indicated based on results of smoke/dye testing;

b. all force mains by surface visual inspection, as appropriate;

c. all appurtenances – i.e., manholes, junction chambers, pump stations – by visual inspection; and

d. all siphons by television inspection.

ii. The City shall perform the inspections of the Collection System in accordance with the SSES Handbook, "Sewer System Infrastructure Analysis and Rehabilitation," EPA/625/6-91/030, 1991 (hereinafter "SSES Handbook"), and sound engineering practice. Inspection of force mains will be carried out utilizing one or more methodologies appropriate to the specific characteristics of each force main. Chapters 3-4 of the SSES Handbook are attached as Appendix B.

iii. **Cross-connections:** The City shall identify and eliminate all physical connections between the Collection System and its stormwater collection system.

iv. The City shall record and prioritize rehabilitation and other corrective action proposed under this Paragraph for all defects identified through the inspections required under this Paragraph.

v. Where any of the Collection System components have been replaced, rehabilitated, or slip-lined pursuant to this Paragraph, the City may request, and EPA and LDEQ may approve, waiver of this Paragraph inspection requirements.

B. **Infiltration and Inflow ("I/I") Evaluation**:

i. As part of the evaluation of each sewershed contributing to the City's Collection System, the City shall complete the evaluation of I/I into that sewershed's Collection System. The evaluations shall include identification of sources of infiltration, sources of inflow and methods for reducing I/I into the Collection System, and the collection and analysis of rainfall and flow monitoring data. For purposes of this Paragraph only, the term "evaluation" shall be interpreted in accordance with the meaning ascribed to that term in sub-chapters 3.3, 3.4, 3.5, 3.6 and Chapter 4 of the SSES Handbook and in accordance with the technical procedures for identification of I/I set forth in sub-chapters 3.3, 3.4, 3.5, 3.6, and Chapter 4 of the SSES Handbook. *See* Appendix B.

ii. As part of the I/I evaluations required by this Paragraph, the City shall conduct rainfall and flow monitoring to:

a. Determine baseline I/I rates in each sewershed;

b. Determine the efficacy of the capital projects previously completed to reduce I/I rates; and

c. Predict the effectiveness of any capital projects started but not yet completed and any additional rehabilitation, or other corrective action proposed by the City in each Sewershed Study Plan to reduce peak wet weather flows and/or to increase transmission and treatment capacity such that Public Property SSOs do not occur.

C. **Long-Term Capacity/Peak Flow Management**:

i. The City shall use the data and information collected and analyzed in its evaluation of each sewershed conducted pursuant to this Paragraph to evaluate whether any construction projects in process or already completed and the projects it proposes and/or completes pursuant to Paragraph 19, below, will ensure adequate long-term transmission capacity in the Collection System. At a minimum, the City shall evaluate the hydraulic capacity of force mains, major gravity lines, and Pumping Stations and their respective related appurtenances (hereinafter referred to as "Collection System Components").

ii. As part of this evaluation, the City shall use the information it is required to develop pursuant to this Paragraph to assess existing and long-term capacity of the Collection System and to assure the ability of the Collection System to transmit peak flows experienced by and predicted for the Collection System.

19. **Collection System Sewershed Rehabilitation Plan**

A. Within one hundred twenty (120) days after the completion of each Sewershed Study, the City shall submit to EPA and LDEQ a Collection System Sewershed Rehabilitation Plan ("Sewershed Rehabilitation Plan") that includes each rehabilitation project, including, but not limited to, each reduction of I/I project and long-term capacity/peak flow management improvement project, anticipated to take more than one year to complete. Each Sewershed Rehabilitation Plan shall include specific rehabilitation projects, including, but not limited to, reduction of I/I and long-term capacity/peak flow management improvement projects, to address the deficiencies identified by the City during its evaluation of its sewersheds, and a schedule for completion of any such proposed rehabilitation projects. Any schedule proposed by the City in

its Sewershed Rehabilitation Plans shall not extend beyond December 28, 2015; notwithstanding, the City may seek modification of this end date in accordance with Section XXII (Modification). Notwithstanding the foregoing, within one hundred twenty (120) days after the completion of the high priority Sewershed Study, referred to in Paragraph 18, the City shall determine and submit to EPA and LDEQ for approval a rehabilitation plan to rehabilitate the areas that most contribute to SSOs and that are not expected to be significantly impacted by the transfer of wastewater flow from the Admiral Doyle Plant to the New Plant. The high priority Rehabilitation Plan may include but may not be limited to the following areas:

i. Areas of the Collection System that directly contribute to the SSOs occurring at or near the intersection of Monterey Street and Santa Clara Street;

ii. Areas of the Collection System that directly contribute to the SSOs occurring at or near the D-7 pump station on Landry Drive; and

iii. Areas of the Collection System that directly contribute to the SSOs occurring at or near the intersection of Duperier Avenue and Nita Street.

B. **The Sewershed Rehabilitation Elements**: In each Sewershed Rehabilitation Plan, the City shall:

i. Identify significant deficiencies discovered during the Collection System inspections conducted pursuant to Paragraph 18, above;

ii. Identify rehabilitation and other corrective actions taken by the City (including but not limited to grouting, point repairs, line replacement) to address the deficiencies identified during evaluation of a sewershed;

iii. Identify all rehabilitation, including, but not limited to, reduction of I/I and long-term capacity/peak flow management improvement projects, and other corrective actions proposed to be taken by the City (including but not limited to grouting, point repairs, line replacement) to address the deficiencies identified during evaluation of a sewershed;

iv. Propose a plan and schedule for implementing rehabilitation, including, but not limited to, reduction of I/I and long-term capacity/peak flow management improvement projects, and other corrective actions determined necessary either to correct deficiencies identified during the evaluations of the City's sewersheds or to ensure operation of the Collection System without causing or contributing to a Public Property SSO; and

v. Use the data and information collected and analyzed in the City's evaluation of each sewershed conducted pursuant to Paragraph 18 and this Paragraph to determine whether the projects the City proposes in this Paragraph will ensure adequate longer-term transmission capacity in the Collection System sufficient to prevent SSOs.

C. **Sewershed Rehabilitation Plan(s) Approval and Implementation**: Upon receipt of EPA's and LDEQ's final approval of the Sewershed Rehabilitation Plan(s), the plans shall be incorporated into, and become enforceable under, this Consent Decree. No later than one hundred twenty (120) days after receipt of EPA and LDEQ final approval of each Sewershed Rehabilitation Plan, the City shall begin implementation of the plan, including any schedule for implementation of rehabilitation and other corrective action, provided that the City will not be

required to begin implementation of any Sewershed Rehabilitation Plan prior to December 30, 2007 or such other date as agreed to by the Parties. The schedules proposed by the City in its Sewershed Rehabilitation Plans, and approved by EPA and LDEQ, are each separately enforceable. Notwithstanding the foregoing, within thirty (30) days after receipt of EPA and LDEQ final approval of the high priority Sewershed Rehabilitation Plan, referred to in Paragraph 19.A, the City shall implement the high priority Sewershed Rehabilitation Plan. "Implement" or "implementation" under this Subparagraph may include but not be limited to the initiation of a construction site survey or the issuance of bid documents.

D. The City shall actively pursue, and report on its efforts to secure, any funding required for the study and rehabilitation of its Collection System.

20. **Private Connections:**

A. **Illegal Private Connections**: Within one hundred eighty (180) days after the Date of Entry of this Consent Decree, the City shall submit to EPA and LDEQ a plan for identifying and eliminating illegal stormwater connections on private property under the City's ordinance Section 90-35. The plan shall include at a minimum a:

i. Discussion of the method(s) of enforcement; and

ii. Program to identify illegal stormwater connections as part of the Sewershed Study and to ensure effective implementation of the ordinance.

B. Within one hundred eighty (180) days after the approval of the plan for the identification and elimination of illegal private stormwater connections, the City shall begin implementing the plan.

C. **Privately Owned Portion of a Customer Service Connection Lateral**: Where a privately owned portion of a customer service connection lateral, that is neither in the public right-of-way nor in a public sanitary sewer easement, is determined to be a significant source of I/I that causes or contributes, or is likely to cause or contribute, to an Overflow from the Collection System, the City, within ninety (90) days of the date of the identification of such a lateral:

i. shall notify the owner(s) of the customer service connection lateral that the lateral is a source of such I/I; and

ii. shall require the owner(s) to take appropriate steps to repair, rehabilitate, or replace that customer service connection lateral; or

iii. may terminate that customer service connection lateral.

D. The City may use public funds to take appropriate steps to repair, rehabilitate, or replace any customer service connection lateral consistent with Louisiana Attorney General Opinion No. 00-14 (Appendix C), unless a court of competent jurisdiction determines that such use of public funds is not permitted under the Constitution of the State of Louisiana. No stipulated penalties shall be assessed for the failure of the City to use public funds to repair, rehabilitate, or replace any customer service connection lateral.

21. **Collection System Operation and Maintenance**

A. The City shall implement a maintenance program for the Collection System, including its gravity sewer lines, force mains, Pump Stations and other appurtenances (e.g., manholes, pressure sewers, inverted siphons, meter vaults), to provide for the proper operation and maintenance of equipment while minimizing failures, malfunctions, and line blockages. The

program shall include:

i. Routine inspection of the Collection System and cleaning gravity sewer lines as necessary;

ii. Routine preventative maintenance of Pump Stations;

iii. Sealing (where appropriate), and maintenance, of manholes;

iv. Identification and remediation of poor construction;

v. Procedures for ensuring that new sewers and connections are properly designed and constructed (including testing of new sewer installations) to prevent overflows and to ensure that new connections of inflow sources are prohibited;

vi. A grease control program that, at a minimum, maps identified grease blockages, notifies pretreatment staff of recurring grease blockages, requires the installation of grease traps or interceptors and/or the implementation of a trap or interceptor cleaning and inspection program, and a proposal that includes scheduled inspection of known problem areas;

vii. A root control program that addresses, at minimum, scheduling and performing corrective measures including both short-term mitigation of root intrusion (i.e., routine maintenance) and rehabilitation of the areas in which root intrusion has caused recurring blockages (i.e., sewer replacement or relining);

viii. Description of method for documenting complaints, work orders, updates to equipment inventory, and changes to Collection System components;

ix. Corrective maintenance response and reporting procedures;

x. Adequately trained staff and adequate equipment to ensure that the City promptly identifies and addresses problems in its sewer system which lead to known SSOs. Within one hundred eighty (180) days following the Date of Entry of this Consent Decree, the City shall ensure that all personnel with decision-making authority regarding the operation of the Collection System obtain wastewater operator training and certification consistent with Louisiana State law; and

xi. Annually update operation and maintenance manuals.

B. The City shall fully implement the maintenance program required under this Paragraph no later than twenty-four (24) months after the Date of Entry of this Consent Decree.

22. **SSO Response Plan**

A. The City shall develop and implement a SSO Response Plan to adequately protect the health and welfare of persons in the event of a Public Property SSO.

B. Within ninety (90) days of the Date of Entry of this Consent Decree, the City shall provide to EPA and LDEQ for approval a SSO Response Plan that addresses the actions to be taken by the City in the event of Public Property SSOs originating from the Collection System or bypasses at the treatment plants. The SSO Response Plan shall include but not be limited to:

i. A detailed description of the actions the City will undertake to immediately provide notice to the public (through the local news media or other means, including signs or barricades to restrict access) of the Public Property SSOs from the Collection System;

ii. A detailed description of the actions the City will undertake to provide notice to appropriate federal, state or local agencies/authorities;

iii. A detailed plan (including the development of response standard operating procedures) for clean-up and to minimize the volume of untreated wastewater transmitted to the portion of the Collection System impacted by the events precipitating the Public Property SSO;

iv. Identification of the personnel and resources who will be made available by the City to correct or repair the condition causing or contributing to the Public Property SSOs;

v. A plan to ensure the preparedness, including response training of the City's employees, contractors, and personnel of other affected agencies necessary for the effective implementation of the SSO Response Plan in the event of a Public Property SSO;

vi. Identification of overflow locations within the sewershed served by each Pump Station and those locations at which a Public Property SSO is most likely to occur first in the event of Pump Station failure for each Pump Station; and

vii. Station-specific emergency procedures and bypass strategies and estimated storage capacity.

In the event that a repair may cause or lengthen the time of a Public Property SSO, the SSO Response Plan shall provide a procedure for determining when additional storage or pump around will be needed.

C. Within sixty (60) days of receipt of EPA's and LDEQ's comments on the SSO Response Plan, the Parties will meet and confer, as needed, to discuss the development and implementation of the SSO Response Plan, and agree on any modifications. Upon final approval

by EPA and LDEQ, the SSO Response Plan shall be incorporated into, and become enforceable under, this Consent Decree. Within thirty (30) days of EPA and LDEQ final approval, the City shall implement the SSO Response Plan.

D. Any dispute with respect to any portion of the SSO Response Plan required by this Paragraph shall not delay the development or implementation of the undisputed portions of the SSO Response Plan.

23. **Reporting of Known Public Property SSO Events and Recordkeeping**

A. The City shall report to LDEQ by oral notification any Public Property SSO from the portions of the Collection System within the geographic boundaries of the City within twenty-four (24) hours of the time the City first becomes aware of the SSO. A written report shall also be provided to EPA and LDEQ within five (5) days of the time the City first becomes aware of the SSO. Any written report shall be made to the Water Enforcement Division, United States Environmental Protection Agency, Region VI and to the Office of Environmental Compliance, Water Management Administration, LDEQ. The written report shall contain the following:

i. Location of the SSO by street address, or any other appropriate method (i.e., by latitude and longitude);

ii. Name of the receiving water, if applicable, including via separate storm sewer;

iii. An estimate of the volume of sewage discharged;

iv. Description of the sewer system or treatment plant component from which the SSO was released (such as manhole, crack in pipe, pump station wet well or constructed overflow pipe);

v. Cause or suspected cause of the SSO;

vi. Estimated date and time when the SSO began and stopped or the anticipated time the overflow is expected to continue;

vii. Steps taken to respond to the SSO;

viii. Steps taken to reduce, eliminate, and prevent reoccurrence of the SSO and a schedule of major milestones for those steps where appropriate; and

ix. Whether there has already been a notification to the public and other City or Parish Agencies or Departments and how the notification was done.

B. The City shall maintain records of the following information for each Public Property SSO from the Collection System in accordance with Section XVI (Information Collection and Retention), below:

i. The location of the overflow and receiving water, if any;

ii. An estimate of the volume of the overflow;

iii. A description of the sewer system component from which the overflow occurred (e.g., manhole, constructed overflow pipe, crack in pipe, etc.);

iv. The estimated date and time when the overflow began and when it stopped;

v. The cause or suspected cause of the overflow;

vi. Response actions taken;

vii. Steps that have been and will be taken to prevent the overflow from recurring and a schedule for those steps including:

a. work order records associated with investigation and repair of system problems related to public property SSOs; and

b. documentation of performance and implementation measures; and

viii. A list and description of complaints from customers or others regarding overflows.

C. The City shall maintain a copy of any written reports prepared pursuant to this Paragraph in accordance with Section XVI (Information Collection and Retention), below.

VIII. OUTREACH AND PUBLIC AWARENESS

24. The Parties agree that an effective public education program will assist in fulfilling the purpose of this Consent Decree. This is particularly important in advising the public of steps they can take to minimize impact on the Collection System, improve environmental compliance, and educate local groups. Accordingly, the City shall develop, implement, and submit to EPA and LDEQ an Outreach and Public Awareness Program within one hundred eighty (180) days after the Date of Entry of this Consent Decree.

IX. REPORTING REQUIREMENTS

25. The City shall submit to EPA and LDEQ progress reports which satisfy the following requirements in the manner specified in each Subparagraph below:

A. Within thirty (30) days after the end of the first full quarter period (i.e., February 1 to April 30; May 1 to July 31; August 1 to October 31; and November 1 to January 31) following the Date of Entry of this Consent Decree, and within thirty (30) days after the end of each quarter period thereafter, the City shall report its progress towards compliance with Paragraph 13 (Construction of a New Wastewater Treatment Facility), above, until construction of the facility is completed.

B. The City shall report on an annual basis regarding its compliance with Paragraph 16 (Sewage Sludge Management), above, as part of the annual beneficial reuse report.

C. Within thirty (30) days after the end of the first full quarter period (i.e., February 1 to April 30, May 1 to July 31, August 1 to October 31, and November 1 to January 31) following the Date of Entry of this Consent Decree, and within thirty (30) days after the end of each half year period thereafter (i.e., November 1 to April 30, May 1 to October 31), the City shall report its progress towards implementing and completing each Sewershed Study Plan. The progress report shall provide the following information:

i. A summary tabulation of deficiencies identified during the previous reporting period through the inspection conducted pursuant to Paragraph 18, above;

ii. The date of completion of each sewershed study completed during the quarter;

iii. A summary of the length (in feet) of gravity sewer lines inspected in each completed service area during the previous reporting period; and

iv. A summary of rainfall and flow monitoring data collected for the period ending thirty (30) days before the end of the reporting period (organized by sewershed and sewershed service area where appropriate), which shall at a minimum provide daily rainfall amounts, peak hourly rainfall intensity, daily flow volumes, and peak flow rates for each location at which flow monitoring is carried out.

D. Within thirty (30) days after the end of the first full quarter period (i.e., February 1 to April 30; May 1 to July 31; August 1 to October 31; and November 1 to January 31) following December 30, 2007 or such other date as agreed to by the Parties, and within thirty (30) days after the end of each half year period thereafter (i.e., November 1 to April 30, May 1 to October 31), the City shall report its progress towards completing the rehabilitation of each sewershed required by Paragraph 19 (Collection System Sewershed Rehabilitation Plan), above. The

progress report shall provide a summary of the City's progress towards implementing and completing each Sewershed Rehabilitation Plan, including a description of progress toward implementing each project anticipated to take more than one year to complete.

E. Within thirty (30) days after the end of the first full quarter period (i.e., February 1 to April 30; May 1 to July 31; August 1 to October 31; and November 1 to January 31) following the Date of Entry of this Consent Decree, and within thirty (30) days after the end of each half year period thereafter (i.e., November 1 to April 30, May 1 to October 31), the City shall report its progress toward compliance with the provisions of Subparagraph 20.C (Privately Owned Portion of a Customer Service Connection Lateral), above.

F. Within thirty (30) days after the end of the first full half year period (i.e., November 1 to April 30, May 1 to October 31) following the Date of Entry of this Consent Decree, the City shall report its progress toward compliance with the provisions of Paragraph 21 (Collection System Operation and Maintenance), above. After implementation of the maintenance program required under Paragraph 21, the City shall submit an annual report on or before the fifteenth day of May of each year following the reporting year providing:

i. The number of complaints related to the Collection System;

ii. The number of completed work orders for the calendar year being reported;

iii. A list of outstanding work orders;

iv. The number of new sewer installations and rehabilitations and the number of tests performed on such installations and rehabilitations;

v. An evaluation of the efficacy of the grease control program (summary of grease-related blockages identified and corrective action taken); and

vi. An evaluation of the efficacy of the root control program (summary of root-related blockages identified and corrective action taken)

26. Unless otherwise provided specifically in Paragraph 25, above, the City shall submit each progress report to EPA and LDEQ until termination of this Consent Decree pursuant to Section XXIII (Termination). The City may submit the individual progress reports as one combined submittal to EPA and one combined submittal to LDEQ provided the reporting periods and submittal dates are the same.

27. If the City violates any requirement of this Consent Decree, the City shall notify the United States and LDEQ of such violation and its likely duration in writing within fifteen (15) working days of the day the City first become aware of the violation, with an explanation of the violation's likely cause and of the remedial steps taken, and/or to be taken, to prevent or minimize such violation. If the cause of a violation cannot be fully explained at the time the report is due, the City shall include a statement to that effect in the report. The City shall investigate to determine the cause of the violation and then shall submit an amendment to the report, including a full explanation of the cause of the violation, within thirty (30) days of the day the City become aware of the cause of the violation. Nothing in this Paragraph relieves the City of its obligation to provide the requisite notice for purposes of Section XIV (Force Majeure).

28. In the case of any noncompliance that may pose an immediate threat to the public health, welfare, or the environment, the City shall notify EPA and LDEQ orally or by electronic or facsimile transmission as soon as possible, but not later than 24 hours after the City first knew of the noncompliance. This procedure is in addition to the requirements set forth in the preceding Paragraph and the requirements in Paragraph 23 for reporting SSOs.

29. All reports shall be submitted to the persons designated in Section XIX of this Consent Decree (Notices).

30. Each report submitted by the City under this Section shall be signed by an official of the submitting party and include the following certification:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my directions and my inquiry of the person(s) who manage the system, or the person(s) directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing and willful submission of a materially false statement.

31. The reporting requirements of this Consent Decree do not relieve the City of any reporting obligations required by the CWA or implementing regulations, or by any other federal, state, or local law, regulation, permit, or other requirement. Upon the Date of Entry of this Consent Decree, this Consent Decree shall supercede the following Administrative Orders: Administrative Order VI-90-1653, Administrative Order VI-95-1234, Administrative Order VI-96-1203, Administrative Order VI-98-1010, Administrative Order CWA-6-1219-99, Administrative Order VI-95-1240, Administrative Order VI-95-1241, and Administrative Order VI-98-1017.

32. Any information provided pursuant to this Consent Decree may be used by the United States in any proceeding to enforce the provisions of this Consent Decree and as otherwise permitted by law.

X. CIVIL PENALTY

33. The City shall pay a civil penalty in the amount of TWO HUNDRED THIRTY-FIVE THOUSAND DOLLARS ($235,000). Payment shall be due within thirty (30) days after the Date of Entry of this Consent Decree. Payment of the civil penalty shall be made as follows:

A. The City shall pay the sum of ONE HUNDRED SEVENTEEN THOUSAND FIVE HUNDRED DOLLARS ($117,500.00) as a civil penalty, together with interest accruing from the date on which this Consent Decree is lodged with the Court, at the rate specified in 28 U.S.C. § 1961 as of the date of lodging. Payment shall be made by FedWire Electronic Funds Transfer ("EFT") to the U.S. Department of Justice in accordance with instructions to be provided to the City following lodging of this Consent Decree by the Financial Litigation Unit of the U.S. Attorney's Office for the Western District of Louisiana. At the time of payment, the City shall simultaneously send written notice of payment and a copy of any transmittal documentation (which should reference DOJ case number #90-5-1-1-07473 and the civil action number of this case) to the United States in accordance with Section XIX of this Consent Decree (Notices).

B. The City shall pay the sum of ONE HUNDRED SEVENTEEN THOUSAND FIVE HUNDRED DOLLARS ($117,500.00) as a civil penalty, together with interest accruing from the date on which this Consent Decree is lodged with the Court, to the State in the form of a certified check, made payable to the "Louisiana Department of Environmental Quality," and delivered to Darryl Serio, Office of the Secretary, P.O. Box 82263, Baton Rouge Louisiana, 70884.

XI. INTERIM EFFLUENT LIMITATIONS

34. With respect to the Admiral Doyle Plant, given that the City has begun construction of the New Plant, the interim relief provisions of this Paragraph shall be in effect beginning on

the Date of Lodging of this Consent Decree and ending on the ninetieth (90^{th}) day following the date of completion of construction pursuant to Paragraph 13, above. During this period, the City shall not be liable for stipulated penalties for failure to comply with the monthly average effluent limitations for TSS and ammonia as specified in NPDES Permit No. LA0044008, provided that the monthly average amount of TSS and ammonia discharged from the Admiral Doyle Plant does not exceed 20 mg/l and 8 mg/l, respectively; or for stipulated penalties for failure to comply with the daily maximum effluent limitations for $cBOD_5$, TSS, and ammonia as specified in NPDES Permit No. LA0044008, provided that the daily maximum amount of $cBOD_5$, TSS, and ammonia discharged from the Admiral Doyle Plant does not exceed 20 mg/l, 45 mg/l, and 14 mg/l, respectively.

35. With respect to the Tete Bayou Plant, given that the Sewerage District has begun construction of the equalization basin, the interim relief provisions of this Paragraph shall be in effect beginning on the Date of Lodging of this Consent Decree and ending on the ninetieth (90^{th}) day following August 30, 2005 or the actual date of completion of construction pursuant to Paragraph 15, above, if the actual date of completion of construction occurs before or after August 30, 2005. During this period, the City shall not be liable for stipulated penalties for failure to comply with the daily maximum effluent limitations for $cBOD_5$ and TSS as specified in NPDES Permit No. LA0065251, provided that the daily maximum amount of $cBOD_5$ and TSS discharged from the Tete Bayou Plant does not exceed 33 mg/l and 27 mg/l, respectively.

XII. STIPULATED PENALTIES

36. The City shall be liable for Stipulated Penalties to the United States and the State for violations of this Consent Decree as specified below, unless excused under Section XIV (Force

Majeure). A violation includes failing to perform any obligation required by this Consent Decree, including any work plan or schedule approved under this Consent Decree, according to all applicable requirements of this Consent Decree and within the specified time schedules established by or approved under this Consent Decree.

Compliance Measures

A. The City of New Iberia shall pay stipulated penalties to the United States and the State of Louisiana for each day it fails to meet any of the milestone dates required in Paragraph 13, above, for the construction of the New Wastewater Treatment Facility identified therein and for each day it fails to implement and complete an approved Sewershed Study Plan and any approved Sewershed Rehabilitation Plan(s) as required by Paragraphs 18 and 19, above, according to the schedules approved pursuant to the respective Paragraphs. The stipulated penalties collectively payable to the United States and the State of Louisiana per day for each failure to meet each milestone date are as follows:

Period of Noncompliance	Penalty per Milestone Date per Day of Violation
1st to 30th day	$ 200
31st to 60th day	$ 500
61st to 90th day	$ 1,500
After 90 days	$ 5,000

B. Given that the City has begun construction of the New Wastewater Treatment Facility, and provided that the City begins implementation of the Sewershed Study Plan and Sewershed Rehabilitation Plans under Paragraphs 18 and 19, above, by the dates established in the approved schedules, upon demand, the City shall place in an EPA-approved, interest bearing, escrow

account any stipulated penalties due for failure to meet an interim construction deadline or interim milestone date. Within thirty (30) days after completion of construction of the New Wastewater Treatment Facility under Paragraph 13, each sewershed study under Paragraph 18, and the remedial action required under each Sewershed Rehabilitation Plan, the City shall pay the stipulated penalties and accrued interest relating to each separate project to the United States and the State of Louisiana, unless the City can demonstrate that it met the final date contained in the approved schedule for the completion of the particular project or study, upon which demonstration, that portion of the accrued stipulated penalties related to that particular project or study shall be returned to the City.

C. The City shall pay stipulated penalties to the United States and the State of Louisiana for each day it fails to meet any of the requirements set forth in Subparagraphs 16.A. and B., above, for the sewage sludge management. The stipulated penalties collectively payable to the United States and the State of Louisiana per day are as follows:

Period of Noncompliance	Penalty per Milestone Date per Day of Violation
1st to 30th day	$ 200
31st to 60th day	$ 500
After 60 days	$ 1,500

D. The City shall pay stipulated penalties to the United States and the State of Louisiana for each day it fails to submit a complete SSO Characterization Report by the milestone dates identified in Paragraph 17, above; and a Sewershed Rehabilitation Plan(s) by the milestone dates identified in Paragraph 19, above. The stipulated penalties collectively payable to the United States and the State of Louisiana per day for each failure to meet each milestone date are as

follows:

Period of Noncompliance	Penalty per Milestone Date per Day of Violation
1st to 30th day	$ 250
31st to 60th day	$ 500
61st to 90th day	$ 2,250
After 90 days	$ 5,000

E. The City shall pay stipulated penalties to the United States and the State of Louisiana for its failure to submit and implement a plan for identifying and eliminating illegal private connections as specified in Paragraph 20, above. The stipulated penalties collectively payable to the United States and the State of Louisiana per day for the City's failure to submit and implement the program are as follows:

Period of Noncompliance	Penalty per Element per Day of Violation
1st to 30th day	$ 250
31st to 60th day	$ 500
61st to 90th day	$ 850
After 90 days	$ 3,500

Upon demand, the City shall pay stipulated penalties due for failure to meet the milestone dates set in Subparagraphs 20.A. and B. into an EPA-approved, interest bearing, escrow account. Upon complete implementation of the approved plan for identification and elimination of illegal private connections, the City shall pay such stipulated penalties, with all accrued interest, to the United States and the State of Louisiana, unless the City can demonstrate that it has fully

implemented the approved plan within two (2) years following the Date of Entry of this Consent Decree.

F. The City shall pay stipulated penalties to the United States and the State of Louisiana for its failure to fully implement the maintenance program by the milestone date set forth in Paragraph 21, above, and an SSO Response Plan set forth in Paragraph 22, above, by the dates required therein. The stipulated penalties collectively payable to the United States and the State of Louisiana per day for the City's failure to implement and/or complete any of the elements identified in this Paragraph are as follows:

Period of Noncompliance	Penalty per Element per Day of Violation
1st to 30th day	$ 250
31st to 60th day	$ 500
61st to 90th day	$ 850
After 90 days	$ 1,500

G. The City shall pay stipulated penalties to the United States and the State of Louisiana for each day it fails to submit the Progress Reports identified in Paragraph 25 by the milestone dates in this Consent Decree for the submittal of such reports. The stipulated penalties collectively payable to the United States and the State of Louisiana per day for each failure to submit each report by the milestone date are as follows:

Period of Noncompliance	Penalty per Day
1st to 30th day	$ 200
31st to 60th day	$ 500
After 60 days	$ 1,500

H. The City shall pay stipulated penalties to the United States and the State of Louisiana for each day it fails to report SSO Events pursuant to Paragraph 23 by the dates required in this Consent Decree for the submittal of such reports. The stipulated penalties collectively payable to the United States and the State of Louisiana per day for the City's failure to submit or maintain the reports or implement the Plan identified in this Paragraph are $ 1,000 per day.

I. Sanitary Sewer Overflows: The City will pay stipulated penalties to the United States and the State of Louisiana for all SSOs in the amount set forth in this Paragraph. Notwithstanding the foregoing, the City shall not be liable for stipulated penalties for SSOs which originate in a sewershed prior to the completion of the Collection System Sewershed Rehabilitation Plan for that sewershed if all of the following conditions are met:

(i) The City stopped the SSO(s) as soon as possible;

(ii) The City is in compliance with its Operation and Maintenance Program (Paragraph 21) and its SSO Response Plan (Paragraph 22); and

(iii) The City is in compliance with the schedules in its Sewershed Rehabilitation Plans (Paragraph 19) for each sewershed.

The stipulated penalties collectively payable to the United States and the State of Louisiana per Overflow event are as follows:

Less than 100 gallons	$50
100 to 2,499 gallons	$200
2,500 to 9,999 gallons	$400

10,000 to 99,999 gallons	$1,000
100,000 to 999,999 gallons	$3,000
1 million gallons or more	$5,000

J. Non-Compliant Discharge: The City will pay one-half of the stipulated penalties set forth below to the United States and the State of Louisiana for any discharge in violation of interim limits or its applicable NPDES permit, including any stockpiling of sludge or stabilized biosolids outside of the containment area (Paragraph 16). The stipulated penalties collectively payable to the United States and the State of Louisiana per day for each non-compliant discharge, failure to monitor and report as required, or stockpiling sludge or stabilized biosolids in violation of sewage sludge management requirements are as follows:

Permit Violation	Penalty per Violation
Exceedance(s) of the daily maximum limit or other non-monthly average limit	$ 1,000
Exceedance(s) of monthly average limits	$ 2,500
Failure to comply with a Monitoring and Reporting Requirement	$ 500
Stockpiling sludge or biosolids in violation of sewage sludge management requirements	$ 1,000

37. Stipulated Penalties under this Section shall begin to accrue on the day after performance is due or on the day a violation occurs, whichever is applicable, and shall continue to accrue until performance is satisfactorily completed or until the violation ceases. Stipulated Penalties shall accrue simultaneously for separate violations of this Consent Decree. The United States, or the State, or both may seek Stipulated Penalties under this Section. Where both sovereigns seek Stipulated Penalties for the same violation of this Consent Decree, the City shall pay fifty percent to the United States and fifty percent to the State. Where only one sovereign demands Stipulated Penalties for a violation, and the other sovereign does not join in the demand within thirty (30) days of receiving the demand, or timely joins in the demand but subsequently elects to waive or reduce Stipulated Penalties for that violation, the City shall pay the Stipulated Penalties due for the violation to the sovereign making the initial demand, less any amount paid to the other sovereign. The determination by one sovereign not to seek Stipulated Penalties shall not preclude the other sovereign from seeking Stipulated Penalties.

38. The United States or the State may, in the unreviewable exercise of its discretion, reduce or waive Stipulated Penalties otherwise due that sovereign under this Consent Decree.

39. Stipulated Penalties shall continue to accrue during any Dispute Resolution, with interest on accrued penalties payable and calculated at the rate established by the Secretary of the Treasury, pursuant to 28 U.S.C. § 1961, but need not be paid until the following:

a. If the dispute is resolved by agreement that is not appealed to the Court, the City shall pay accrued penalties determined by the Parties to be owing, together with interest, to the United States within thirty (30) days of the Effective Date of the agreement or the receipt of EPA's decision or order;

b. If the dispute is resolved by a decision of EPA that is not appealed to the Court, the City shall pay accrued penalties determined by EPA to be owing, together with interest, to the United States within thirty (30) days of the Effective Date of the agreement or the receipt of EPA's decision or order;

c. If the dispute is appealed to the Court and the United States prevails in whole or in part, the City shall pay all accrued penalties determined by the Court to be owing, together with interest, within sixty (60) days of receiving the Court's decision or order, except as provided in Subparagraph d, below;

d. If any Party appeals the District Court's decision, the City shall pay all accrued penalties determined by the Court to be owing, together with interest, within fifteen (15) days of receiving the final appellate court decision.

40. Upon demand, except as otherwise provided in Subparagraphs 36.B and E, above, the City shall pay Stipulated Penalties occurring between the date of lodging and the Effective Date of this Consent within thirty (30) days of the Effective Date of this Consent Decree.

41. Upon demand, except as otherwise provided in Subparagraphs 36.B and E, above, the City shall, as directed by the United States, pay Stipulated Penalties owing to the United States by EFT in accordance with Section X (Civil Penalty), above; and as directed by the State, pay Stipulated Penalties owing to the State by certified check in accordance with Section X.

42. If the City fails to pay Stipulated Penalties according to the terms of this Consent Decree, the United States and the State shall be entitled to collect interest on such penalties, as provided for in 28 U.S.C. § 1961.

43. Subject to the provisions of Section XVII of this Consent Decree (Effect of Settlement/Reservation of Rights), the Stipulated Penalties provided for in this Consent Decree shall be in addition to any other rights, remedies, or sanctions available to the United States or the State for the City's violation of this Consent Decree or applicable law. Where a violation of this Consent Decree is also a violation of relevant statutory or regulatory requirements, the City shall be allowed a credit, for any Stipulated Penalties paid, against any statutory penalties imposed for such violation.

XIII. REVIEW OF SUBMITTALS

44. After review of any plan, report, or other item that is required to be submitted pursuant to this Consent Decree, EPA, after consultation with LDEQ, shall in writing: (a) approve the submission; (b) approve the submission upon specified conditions; (c) approve part of the submission and disapprove the remainder; or (d) disapprove the submission.

45. If the submission is approved pursuant to Subparagraph 44(a), the City shall take all actions required by the plan, report, or other item, as approved. If the submission is conditionally approved or approved only in part, pursuant to Subparagraph 44(b) or (c), the City shall, upon written direction of EPA, after consultation with LDEQ, take all actions required by the approved plan, report, or other item that EPA and LDEQ determine are technically severable from any disapproved portions, subject to the City's right to dispute only the specified conditions or the disapproved portions, under Section XV of this Consent Decree (Dispute Resolution).

46. If the submission is disapproved in whole or in part pursuant to Subparagraph 44(c) or (d), the City shall, within forty-five (45) days or such other time as the Parties agree in writing, correct all deficiencies and resubmit the plan, report, or other item, or disapproved portion thereof, for approval.

47. If a resubmitted plan, report, or other item, or portion thereof, is disapproved in whole or in part, EPA, after consultation with LDEQ, may again require the City to correct any deficiencies, in accordance with this Section, subject to the City's right to invoke Dispute Resolution.

48. If EPA fails to notify the City of its approval or disapproval, or otherwise provide comments, within sixty (60) days after receiving the submittal, the completion dates for each milestone in the submittal, once approved, shall be extended by the number of days beyond sixty (60) that EPA and LDEQ took for such approval, disapproval or comment provided that the City can demonstrate that such an extension is reasonable and necessary to meet the deadlines contained therein.

XIV. FORCE MAJEURE

49. A "force majeure event" is any event beyond the control of the City, its contractors, or any entity controlled by the City that delays the performance of any obligation under this Consent Decree despite the City's best efforts to fulfill the obligation. "Best efforts" includes anticipating any potential force majeure event and addressing the effects of any such event (a) as it is occurring and (b) after it has occurred, to prevent or minimize any resulting delay to the greatest extent possible. "Force Majeure" does not include the City's financial inability to perform any obligation under this Consent Decree.

50. The City shall provide notice orally or by electronic or facsimile transmission as soon as possible, but not later than 72 hours after the time the City first knew of, or by the exercise of best efforts, should have known of, a claimed force majeure event. The City shall also provide written notice, as provided in Section XIX of this Consent Decree (Notices), within seven (7)

business days of the time the City first knew of, or by the exercise of best efforts, should have known of, the event. The notice shall state the anticipated duration of any delay; its cause(s); the City's past and proposed actions to prevent or minimize any delay; a schedule for carrying out those actions; and the City's rationale for attributing any delay to a force majeure event. Failure to give such notice shall preclude the City from asserting any claim of force majeure. The City shall be deemed to know of any circumstance of which the City, its contractors, or any entity controlled by the City knew or, through best efforts, should have known. Timely notice under this Paragraph by the Sewerage District shall be deemed timely notice by the City.

51. If the United States agrees that a force majeure event has occurred, the United States may agree to extend the time for the City to perform the affected requirements for the time necessary to complete those obligations. An extension of time to perform the obligations affected by a force majeure event shall not, by itself, extend the time to perform any other obligation.

52. If the United States does not agree that a force majeure event has occurred, or does not agree to the extension of time sought by the City, the United States' position shall be binding, unless the City invokes Dispute Resolution under Section XV of this Consent Decree. In any such dispute, the City bears the burden of proving, by a preponderance of the evidence, that each claimed force majeure event is a force majeure event; that the City gave the notice required by this Paragraph that the force majeure event caused any delay the City claims was attributable to that event; and that the City exercised best efforts to prevent or minimize any delay caused by the event.

XV. DISPUTE RESOLUTION

53. Unless otherwise expressly provided for in this Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Consent Decree. However, such procedures shall not apply to actions by the United States to enforce obligations of the City that have not been disputed in accordance with this Section.

54. Informal Dispute Resolution. Any dispute subject to dispute resolution under this Consent Decree shall first be the subject of informal negotiations. The dispute shall be considered to have arisen when the City sends the United States a written Notice of Dispute. Such Notice of Dispute shall state clearly the matter in dispute. The period of informal negotiations shall not exceed twenty (20) days from the date the dispute arises, unless that period is modified by written agreement. If the Parties cannot resolve a dispute by good faith informal negotiations, then the position advanced by the United States shall be considered binding unless, within thirty (30) days after the conclusion of the informal negotiation period, the City invokes formal dispute resolution procedures as set forth below.

55. Formal Dispute Resolution. A. The City shall invoke formal dispute resolution procedures, within the time period provided in the preceding Paragraph, by serving on the United States a written Statement of Position regarding the matter in dispute. The Statement of Position shall include, but may not be limited to, any factual data, analysis or opinion supporting the City's position, and any supporting documentation relied upon by the City.

B. The United States shall serve its Statement of Position within forty-five (45) days of receipt of the City's Statement of Position. The United States' Statement of Position shall

include, but may not be limited to, any factual data, analysis, or opinion supporting that position, and all supporting documentation relied upon by the United States. The United States' Statement of Position shall be binding on the City, unless the City files a motion for judicial review of the dispute in accordance with Subparagraph 55.C., below.

C. The City may seek judicial review of the dispute by filing with the Court and serving on the United States, in accordance with Section XIX of this Consent Decree (Notices), a motion requesting judicial resolution of the dispute. The motion must be filed within ten (10) days of the date of receipt of the United States' Statement of Position pursuant to the preceding Subparagraph. The motion shall contain a written statement of the City's position on the matter in dispute, including any supporting factual data, analysis, opinion, or documentation, and shall set forth the relief requested and any schedule within which the dispute must be resolved for orderly implementation of this Consent Decree.

D. The United States shall respond to the City's motion within the time period provided in the Local Rules of this Court, unless the parties stipulate otherwise. The City may file a reply memorandum, to the extent permitted by the Local Rules or the Parties' stipulation, as applicable.

E. In any dispute under this Section, the City shall bear the burden of demonstrating that its position clearly complies with this Consent Decree and the Clean Water Act. With respect to disputes arising under Section VII. B (Remedial Measures), the position of the United States is reviewable only on the administrative record and must be upheld unless arbitrary and capricious or otherwise not in accordance with law.

F. Invoking dispute resolution procedures under this Section shall not extend, postpone, or affect in any way any obligation of the City under this Consent Decree, not directly in dispute,

unless the United States or the Court agrees otherwise. Stipulated Penalties with respect to the disputed matter shall continue to accrue from the first day of noncompliance, but payment shall be stayed pending resolution of the dispute as provided in this Section. If the City does not prevail on the disputed issue, Stipulated Penalties shall be assessed and paid as provided in Section XII (Stipulated Penalties).

XVI. INFORMATION COLLECTION AND RETENTION

56. The United States, the State, and their representatives, including attorneys, contractors, and consultants, shall have the right of entry to any facility covered by this Consent Decree, at all reasonable times, upon presentation of credentials to:

a. monitor the progress of activities required under this Consent Decree;

b. verify any data or information submitted to the United States or the State in accordance with the terms of this Consent Decree;

c. obtain samples and, upon request, splits of any samples taken by the City or its representative, contractors, or consultants;

d. obtain documentary evidence, including photographs and similar data; and

e. assess the City's compliance with this Consent Decree.

57. Upon request, the City shall provide EPA and the State or their authorized representatives splits of any samples taken by the City. Upon request, EPA and the State shall provide the City splits of any samples taken by EPA or the State.

58. Until five (5) years after the termination of this Consent Decree, the City shall retain, and shall instruct its contractors and agents to preserve, all non-identical copies of all records and documents (including records or documents in electronic form) in the City's or its contractors' or

agents' possession or control, or that come into the City's or its contractors' or agents' possession or control, and that relate in any manner to the City's performance of its obligations under this Consent Decree. This record retention requirement shall apply regardless of any corporate or institutional document-retention policy to the contrary. At any time during this record-retention period, the United States or the State may request copies of any documents or records required to be maintained under this Paragraph.

59. At the conclusion of the document-retention period provided in the preceding Paragraph, the City shall notify the United States and the State at least ninety (90) days prior to the destruction of any records or documents subject to the requirements of the preceding Paragraph, and, upon request by the United States or the State, the City shall deliver any such records or documents to EPA or the State. The City may assert that certain documents, records, or other information is privileged under the attorney-client privilege or any other privilege recognized by federal law. If the City asserts such a privilege, it shall provide the following: (1) the title of the document, record, or information; (2) the date of the document, record, or information; (3) the name and title of the author of the document, record, or information; (4) the name and title of each addressee and recipient; (5) a description of the subject of the document, record, or information; and (6) the privilege asserted by the City. However, no documents, reports, or other information created or generated pursuant to the requirements of this Consent Decree shall be withheld on the grounds that they are privileged.

60. This Consent Decree in no way limits or affects any right of entry and inspection, or any right to obtain information, held by the United States or the State pursuant to applicable federal or state laws, regulations, or permits.

XVII. EFFECT OF SETTLEMENT/RESERVATION OF RIGHTS

61. This Consent Decree resolves the civil claims of the United States for the violations of Sections 301 and 402 of the Clean Water Act as alleged in the Complaint filed by the United States, and the claims of the co-plaintiff State of Louisiana for violations of Sections 301 and 402 of the Clean Water Act and La. R.S. 30:2075 and 2076(A) through the date of lodging.

62. This Consent Decree shall not be construed to prevent or limit the rights of the United States or the State to obtain penalties or injunctive relief under the CWA, or under other federal or state laws, regulations, or permit conditions, except as expressly specified herein.

63. The City is responsible for achieving and maintaining complete compliance with all applicable federal, State, and local laws, regulations, and permits; and the City's compliance with this Consent Decree shall be no defense to any action commenced pursuant to said laws, regulations, or permits. This Consent Decree is not a permit, or a modification of any permit, under any federal, State, or local laws or regulations. The United States and the State do not, by their consent to the entry of this Consent Decree, warrant or aver in any manner that the City's compliance with any aspect of this Consent Decree will result in compliance with provisions of the CWA.

64. This Consent Decree does not limit or affect the rights of the City, the United States or the State against any third parties, not party to this Consent Decree, nor does it limit the rights of third parties, not party to this Consent Decree, against the City, except as otherwise provided by law.

65. This Consent Decree shall not be construed to create rights in, or grant any cause of action to, any third party not party to this Consent Decree.

66. The United States and the State reserve all legal and equitable remedies available to enforce the provisions of this Consent Decree, except as expressly stated herein. The United States and the State further reserve all legal and equitable remedies to address any imminent and substantial endangerment to the public health, welfare, or the environment arising at, or posed by, the City's facilities whether related to the violations addressed in this Consent Decree or otherwise.

XVIII. COSTS OF SUIT

67. The Parties shall bear their own costs of this action, including attorneys fees, except that the United States and the State shall be entitled to collect the costs (including attorneys fees) incurred in any action necessary to collect any portion of the civil penalty or any Stipulated Penalties due but not paid by the City.

XIX. NOTICES

68. Unless otherwise specified herein, whenever notifications, submissions, or communications are required by this Consent Decree, they shall be made in writing and addressed as follows:

As to the United States:
Chief,
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, D.C. 20044-7611
Reference: DOJ Case No. 90-5-1-1-07473

As to EPA:
Chief, Water Enforcement Branch (6EN-W)
Compliance Assurance and Enforcement Division
U.S. Environmental Protection Agency, Region VI
1445 Ross Avenue
Dallas, Texas 75202-2733

As to LDEQ:
Peggy Hatch
Administrator
Office of Environmental Compliance
Louisiana Department of Environmental Quality
P.O. Box 4312
Baton Rouge, Louisiana 70821-4312

As to the Defendant:
Hilda Curry, Mayor
Department of Public Works
City of New Iberia
475 East Main Street, Suite 300
New Iberia, Louisiana 70560-3700

James L. Russell, Jr., Director
Department of Public Works
City of New Iberia
475 East Main Street, Suite 300
New Iberia, Louisiana 70560-3700

69. Any Party may, by written notice to the other Parties, change its designated notice recipient or notice address provided above.

70. Notices submitted pursuant to this Section shall be deemed submitted upon mailing, unless otherwise provided in this Consent Decree or by mutual agreement of the Parties in writing. Notifications to or communications, if received, shall be deemed submitted on the date they are postmarked, or when sent by non-postal delivery, the date of pickup provided same is for next day delivery.

XX. EFFECTIVE DATE

71. The Effective Date of this Consent Decree shall be the date upon which this Consent Decree is entered by the Court.

XXI. RETENTION OF JURISDICTION

72. The Court shall retain jurisdiction of this case until termination of this Consent Decree, for the purpose of enabling any of the Parties to apply to the Court for such further order, direction, or relief as may be necessary or appropriate for the construction or modification of this Consent Decree, or to effectuate or enforce compliance with its terms, or to resolve disputes in accordance with Section XV of this Consent Decree (Dispute Resolution).

XXII. MODIFICATION

73. The terms of this Consent Decree may be modified only by a subsequent written agreement signed by all the Parties. Where the modification constitutes a material change to any term of this Consent Decree, it shall be effective only upon approval by the Court. The terms and schedules contained in the Appendices of this Consent Decree may be modified upon written agreement of the Parties without Court approval, unless any such modification effects a material change to the terms of this Consent Decree or materially affects the City's ability to meet the objectives of this Consent Decree.

XXIII. TERMINATION

74. After the City has demonstrated continuous and satisfactory compliance with the terms and conditions of this Consent Decree for a period of twelve (12) months following the completion of construction of all elements of the Collection System remedial measures related to the Tete Bayou Plant, the New Plant, and the City's Collection System, including compliance with each of the following requirements: remedial measures (Section VII), outreach and public awareness (Section VIII), reporting (Section IX), civil penalties (Section X), and stipulated penalties (Section XII), the City may serve upon the United States and the State a Request for

Termination, stating that the City has satisfied these requirements, together with all necessary supporting documentation.

75. Following receipt by the United States and the State of the City's Request for Termination, the Parties shall confer informally concerning the Request and any disagreement that the Parties may have as to whether the City has satisfactorily complied with the requirements for termination of this Consent Decree. If the United States after consultation with the State agrees that this Consent Decree may be terminated, the Parties shall submit, for the Court's approval, a joint stipulation terminating this Consent Decree.

76. If the United States after consultation with the State does not agree that this Consent Decree may be terminated, the City may invoke Dispute Resolution under Section XV of this Consent Decree. However, the City shall not seek judicial resolution of any dispute until ninety (90) days after service of its Request for Termination.

XXIV. PUBLIC PARTICIPATION

77. This Consent Decree shall be lodged with the Court for a period of not less than thirty (30) days for public notice and comment in accordance with 28 C.F.R. § 50.7. The United States reserves the right to withdraw or withhold its consent if the comments regarding this Consent Decree disclose facts or considerations indicating that this Consent Decree is inappropriate, improper, or inadequate. The City consents to entry of this Consent Decree without further notice.

78. The Parties agree and acknowledge that final approval by the State of Louisiana, Department of Environmental Quality, and entry of this Consent Decree is subject to the requirements of La. R.S. 30:2050.7, which provides for public notice of this Consent Decree in

the official journals of the Parish of Iberia, opportunity for public comment, consideration of any comments, and concurrence by the State Attorney General. This Paragraph does not create any rights exercisable by the City.

XXV. CONTINGENT LIABILITY OF STATE OF LOUISIANA

79. This Consent Decree does not resolve the contingent liability of the State of Louisiana under Section 309(e) of the Act, 33 U.S.C. § 1319(e). The United States specifically reserves its claims against the State, and the State reserves its defenses.

XXVI. SIGNATORIES/SERVICE

80. Each undersigned representative of the City, the State of Louisiana, and the Assistant Attorney General for the Environment and Natural Resources Division of the Department of Justice certifies that he or she is fully authorized to enter into the terms and conditions of this Consent Decree and to execute and legally bind the Party he or she represents to this document.

81. This Consent Decree may be signed in counterparts, and such counterpart signature pages shall be given full force and effect.

82. The City agrees not to oppose entry of this Consent Decree by the Court or to challenge any provision of this Consent Decree, unless the United States has notified the City in writing that it no longer supports entry of this Consent Decree.

83. The City agrees to accept service of process by mail with respect to all matters arising under or relating to this Consent Decree and to waive the formal service requirements set forth in Rule 4 of the Federal Rules of Civil Procedure and any applicable Local Rules of this Court including, but not limited to, service of a summons.

XXVII. INTEGRATION/APPENDICES

84. This Consent Decree and its Appendices constitute the final, complete, and exclusive agreement and understanding among the Parties with respect to the settlement embodied in this Consent Decree and supersede all prior agreements and understandings, whether oral or written. Other than the Appendices, which are attached to and incorporated in this Consent Decree, no other document, nor any representation, inducement, agreement, understanding, or promise, constitutes any part of this Consent Decree or the settlement it represents, nor shall it be used in construing the terms of this Consent Decree.

XXVIII. FINAL JUDGMENT

85. Upon approval and entry of this Consent Decree by the Court, this Consent Decree shall constitute a final judgment between the United States, the State, and the City. The Court finds that there is no just reason for delay and therefore enters this judgment as a final judgment under Fed. R. Civ. P. 54 and 58.

XXIX. APPENDICES

86. The following appendices are attached to and incorporated into this Consent Decree:

"Appendix A" is a description of the New Plant and certain elements of the remaining scope of services to be provided to the City by engineers during the construction of the New Plant;

"Appendix B" is Chapters 3-4 of the SSES Handbook: *Sewer System Infrastructure Analysis and Rehabilitation.*

"Appendix C" is a copy of Louisiana Attorney General Opinion No. 00-14, dated July 5, 2000.

"Appendix D" is a map of the City of New Iberia with markings that identify the following three areas described in Paragraphs 17, 18, and 19, above:

i. The intersection of Monterey Street and Santa Clara Street;

ii. The D-7 pump station on Landry Drive; and

iii. The intersection of Duperier Avenue and Nita Street.

Dated and entered this 26 day of October, 2005

UNITED STATES DISTRICT JUDGE

FOR THE UNITED STATES OF AMERICA:

Date: 7/6/05

Kelly A Johnson

KELLY A. JOHNSON
Acting Assistant Attorney General
Environment and Natural Resources Division
United States Department of Justice

Date: 7/6/05

Richard Gladstein

RICHARD GLADSTEIN
Senior Counsel
Environmental Enforcement Section
Environment and Natural Resources Division
United States Department of Justice
P.O. Box 7611
Washington, D.C. 20044-7611
(202) 514-1711

FOR THE UNITED STATES OF AMERICA:

Date: 7-12-05

DONALD WASHINGTON
United States Attorney
Western District of Louisiana

Date: 7/11/05

JANICE E. HEBERT
Assistant United States Attorney
United States Attorney's Office
Western District of Louisiana
800 Lafayette Street, Suite 2200
Lafayette, Louisiana 70501-7206
(337) 262-6618

FOR THE ENVIRONMENTAL PROTECTION AGENCY:

Date:_____

WALKER B. SMITH
Director
Office of Civil Enforcement
United States Environmental Protection Agency
Washington, D.C. 20460

FOR THE ENVIRONMENTAL PROTECTION AGENCY:

Date: 06.15.05

RICHARD E. GREENE
Regional Administrator
U.S. Environmental Protection Agency, Region VI
1445 Ross Avenue
Dallas, Texas 75202-2733

Date: 6/3/05

YERUSHA BEAVER
Assistant Regional Counsel (6RC-EW)
Environmental Protection Agency, Region VI
1445 Ross Avenue
Dallas, Texas 75202

OF COUNSEL:

ELYSE DIBIAGIO-WOOD
Attorney/Advisor
Office of Regulatory Enforcement
United States Environmental Protection Agency
1200 Pennsylvania Ave, NW
Washington, D.C. 20460

FOR THE STATE OF LOUISIANA, THROUGH THE DEPARTMENT OF ENVIRONMENTAL QUALITY:

Date: 6-7-05

HAROLD LEGGETT, Ph.D.
Assistant Secretary
Office of Environmental Compliance
Louisiana Department of Environmental Quality
P.O. Box 4312
Baton Rouge, Louisiana 70821-4312

Date: 6-1-05

TED R. BROYLES, II
SENIOR ATTORNEY
Office of the Secretary
Legal Services Division
Louisiana Department of Environmental Quality
P.O. Box 4302
Baton Rouge, Louisiana 70821-4302

FOR THE CITY OF NEW IBERIA :

Date:_____

HILDA CURRY, MAYOR
City of New Iberia
457 East Main Street, Suite 300
New Iberia, Louisiana 70560-3700

Date:_____

THEODORE M. HAIK, JR.
Attorney for City of New Iberia
1017 E. Dale Street
P.O. Box 11040
New Iberia, LA 70562-1040

Date:_____

DAVID P. MINVIELLE
Lemle & Kelleher, L.L.P.
2100 Pan American Life Center
601 Poydras Street
New Orleans, LA 70130
Attorney for City of New Iberia

FOR THE CITY OF NEW IBERIA :

Date:_____

HILDA CURRY, MAYOR
City of New Iberia
457 East Main Street, Suite 300
New Iberia, Louisiana 70560-3700

Date:_____

THEODORE M. HAIK, JR.
Attorney for City of New Iberia
1017 E. Dale Street
P.O. Box 11040
New Iberia, LA 70562-1040

Date: June 9, 2005

DAVID P. MINVIELLE
Lemle & Kelleher, L.L.P.
2100 Pan American Life Center
601 Poydras Street
New Orleans, LA 70130
Attorney for City of New Iberia

APPENDIX A

This Appendix is provided for information only and shall not form the basis for any stipulated penalty. The New Plant will have an approximate six (6) million gallon per day capacity and will be built at a recently acquired 150-acre site near the southwest entrance to New Iberia, or at some other location, in accordance with the fourth waste water treatment plant alternative recommended by the Iberia Parish Infrastructure Master Plan, March 2001. Details of the New Plant can be found in the Facility Plan Update for the City of New Iberia and Sewerage District No.1 of Iberia Parish, Louisiana (2002). The City estimates that it will invest approximately thirty million dollars ($30,000,000) in the construction of the New Plant, including site acquisition, construction of an access road, a 30-inch force main from the Admiral Doyle Plant to the New Plant, modification, as required, to abandon the Admiral Doyle Plant, and construction of a large new pump station at the Admiral Doyle Plant location.

By contractual agreement, the remaining scope of services to be provided to the City by engineers during the construction of the New Plant includes the following major elements:

- Preparation of plans, specifications and bidding documents for a new Primary Wastewater Pump Station (to be located at the site of the existing Admiral Doyle Drive Wastewater Treatment Plant) and Force Main (to convey all flow from the new pump station to the new wastewater treatment plant);
- Preparation of Operation and Maintenance Manuals as required by LDEQ in conjunction with requirements related to participation in the State Revolving Loan Fund Program;

EXHIBIT
tabbies "Appendix A"

- Assistance with operator training for the new wastewater treatment plant and pump station/force main;
- Preparation of the plant performance review document representing the first year of operation after completion of plant construction.

United States
Environmental Protection
Agency

Office of
Research and Development
Cincinnati, OH 45268

EPA/625/6-91/030
October 1991

Technology Transfer

EPA

Handbook

Sewer System Infrastructure Analysis and Rehabilitation

EPA/625/6-91/030
October 1991

Handbook

Sewer System Infrastructure Analysis and Rehabilitation

U.S. Environmental Protection Agency
Office of Research and Development

Center for Environmental Research Information

Cincinnati, OH 45268

CHAPTER 3

Preliminary Analysis of Sewer Systems

3.1 Introduction

This chapter presents information on how to conduct a preliminary sewer system analysis to determine quickly and easily if there are serious infiltration/inflow (I/I) problems, evaluate the extent of these problems, and select the approach for further analysis and investigation.

Before implementing a thorough I/I analysis and Sewer System Evaluation Survey (SSES), a preliminary analysis of the sewer system should be conducted to quickly establish the degree of I/I in the system. For systems that have not been evaluated, the following occurrences indicate the need for a preliminary sewer system analysis:

- Greater than anticipated flows measured at the wastewater treatment plant
- Flooded basements during periods of intensive rainfall
- Lift station overflows
- Sewer system overflows or by-passes
- Excessive power costs for pumping stations
- Overtaxing of lift station facilities, often resulting in frequent electric motor replacements
- Hydraulic overloading of treatment plant facilities
- Excessive costs of wastewater treatment including meter charges levied by sanitary districts or other jurisdictional authorities
- Aesthetic and water quality problems associated with by-passing of raw wastewater
- Surcharging of manholes resulting in a loss of pipe overburden through defective pipe joints and eventual settlement or collapse
- Odor complaints
- Structural failure
- Corrosion

3.2 Historical Reasons for Sewer System Analysis and Evaluation

Historically, the evaluation of sewer systems has occurred because of regulatory requirements to receive Federal funding; capacity limitations; structural failure; and indirect evidence of excessive I/I in the overall system. I/I problems are often abated by the construction of relief sewers, larger lift stations and treatment plants, and by the use of wastewater bypasses throughout the system. This last approach, however, often results in untreated wastewater flows being discharged into rivers, streams, lakes and open ditches which is no longer acceptable as a solution. An effective sewer system evaluation and rehabilitation plan will be required for effective protection of the infrastructure in nearly all cases regardless of the initial reasons for the evaluation.

3.2.1 Regulatory Requirements

Regulations promulgated as a result of Public Law 92-500 require that any engineer or public official concerned with the design of improvements to existing sewer system infrastructure components or wastewater treatment plants become familiar with and follow certain procedures to insure that excessive I/I was not present in order to become eligible for U.S. EPA grant funding.

Although many changes in the regulations have since been made, the underlying importance of preserving sewer system capacity and structural integrity remains. As shown in Table 2-1, many state regulatory officials still follow a rigorous state review and approval process for improvements to sewer system infrastructure components.

3.2.2 Structural Failure

Wastewater collection system structural failures often occur due to H_2S crown corrosion, natural ageing, and factors such as defective design, excessive overburden, soil settlement, and earthquakes. The historical method for repairing structural problems in sewer systems was to excavate and replace the pipe. With the advent of new technologies, described herein, rehabilitation of wastewater collection lines has became more cost effective and can often be accomplished without extensive excavation and replacement.

3.2.3 Capacity Limitations

With the natural increase in population and industrial growth within a city, the capacity of the wastewater pipes often become insufficient. Sewer collection lines and

treatment plants become inadequate to handle the increase in sanitary flows. Without the correction of excessive I/I, existing sewer lines, are unable to carry the increased flows, thus prohibiting expansion and growth within the existing tributary area.

3.2.4 Citizens' Complaints

Citizens' complaints are often reported during periods of extensive rainfall because sewers surcharge and cause local, area, and residential flooding. When such phenomena occur on a regular basis, a preliminary analysis of the sewer system is necessary because these complaints indicate that the sewer lines exhibit excessive amounts of I/I during periods of rainfall.

3.3 Financial Reasons for Evaluation of Sewer Infrastructure Needs

3.3.1 Need to Enlarge Service Area

Traditional planning of sewer systems has included allowances for growth and expansion within specific drainage basins or within specific geographical or political subdivisions of communities. As existing systems continue to expand, however, the demands on the existing sewer infrastructure continue to grow and the capacity and condition of existing interceptor sewers, lift stations, and appurtenant structures must be continually evaluated. During these planning activities, it often becomes apparent that existing facilities have experienced deterioration and require rehabilitation or replacement to remain serviceable and to accommodate the flow of expanding service areas.

Evaluation of many existing systems as a part of federally-funded I/I and SSES investigations has often shown that severe deterioration has occurred, thus creating additional financial pressures for future sewer system planning and expansion. Since sewer systems are designed for service lifetimes of 30-50 years or more and the planning of these systems do not normally include replacement financing, future expansion and development planning must take into account the cost of this replacement. The continued expansion of existing collection systems normally continues until the capacity of the critical components of existing collection and treatment systems are reached. Because of the high cost of increasing interceptor and collection system capacity especially in fully developed areas, it is important that I/I be minimized and that the necessary investment be made over the lifetime of existing facilities to preserve their condition and capacity. It is for this reason that the major federal funding sources for sewer construction have emphasized the importance of I/I control and protection of systems from major deterioration due to corrosion.

At any given point in time within a sewered community, there is a continuing need to recognize the: 1) value of the existing sewer infrastructure; 2) condition of the system; 3) rate of deterioration; 4) cost of mitigation of deterioration; 5) estimated remaining service lifetime; and 6) ultimate system capacity. A realistic evaluation of the above factors is a crucial element of sound public works management and a fundamental requirement for effective financial planning of sewer system infrastructure improvements.

3.3.2 Budgetary Planning Needs

Sewer system budgetary planning normally includes the following major cost categories:

- Legal and administrative
- Long term and short term debt
- Short term capital financing
- Operations and maintenance labor
- Operations materials and utilities
- Contingency or reserve funds

These budgets are often prepared on an annual or bi-annual basis and are presented to city council or other governing bodies for approval. Whether wholly or partly financed by sewer or sewer and water revenue bonds, some elements of the sewer system budgets compete with other municipal infrastructure needs.

Evaluation of the age and condition of existing sewer systems allows inclusion of the total system needs into the sewer system operations budget. A well planned sewer system survey will provide information such as:

- Sewer line manhole (other structure) replacement needs and costs
- Lift station equipment needs
- Extent of corrosion of lift station equipment and structures, force mains and down stream receiving sewers
- Immediate and longer term rehabilitation needs
- Long and short term maintenance needs

Although all needs cannot be met by annual operating budgets, the budgeting and expenditure of funds annually for repair, maintenance rehabilitation and replacement of critical sewer system components in many cases can eliminate or reduce the need for major capital expenses at a later date. For example, early identification of deterioration due to corrosion may save over 60 percent of the cost of eventual repair or replacement.

3.3.3 Financial Planning

Financial planning to satisfy infrastructure needs includes the consideration of both the short- and long-term

budgetary needs as described in Section 3.3.2, as well as the growth needs as described in Section 3.3.1. Effective planning must recognize not only the importance of an accurate and realistic assessment of needs, but also knowledge of the alternative financing mechanism that are available. These elements should be considered over a planning period of 15-25 years. It should be recognized that even though the estimated lifetime of major portions of the sewer system infrastructure is 30-50 years, it is necessary to assess the capital improvement needs of existing systems on a routine basis at least every 5-10 years. Sewer system needs should be forecast for 10-25 years and should include short term rehabilitation needs and longer term capital improvements needs.

A major element of financial planning includes the analysis of a wide variety of financing mechanisms available to municipalities, as well as a clear understanding of the required financial resources.

Table 3-1 outlines the advantages and disadvantages of the more common infrastructure financing mechanisms.

3.3.4 Benefits Versus Cost of Sewer System Evaluation

Since the early 1970's, over 90 percent of sewer system evaluations were performed in response to Federal Grant funding requirements as now defined by 40CFR35.2120.

The experience gained during the past 15 years with sewer system evaluation efforts (either I/I or SSES) has proved extremely valuable in identifying the need for precise information regarding the condition of the nation's sewer system infrastructure. Equally important has been the development and refinement of a wide range of cost effective sewer evaluation and rehabilitation techniques. These include: 1) improved sewer system monitoring, analysis and inspection techniques; 2) testing and grouting techniques; 3) slip-lining technology; 4) cured in-place linings; 5) fold and fomed; 6) specialty concrete products and grouting techniques; 7) new coatings; 8) new service lateral techniques; 9) new liners; and 10) new manhole rehabilitation techniques.

Another major finding of sewer system evaluations has been the realization of the extent, impact, and monetary significance of corrosion on existing sewer systems. This alone prompted U.S. EPA to undertake a series of investigations and to publish a design manual in 1985 on sewer system odor and corrosion control techniques.[1] Further concerns over the impact of sewer system corrosion led the U.S. Congress to require U.S. EPA to undertake additional studies and to submit a report to Congress on the costs and impacts of corrosion on the sewer system infrastructure and the effects of rainfall induced infiltration (RII) on sewer systems.[2,3]

Although the costs and benefits of sewer system evaluation have not been explicitly defined on a national basis in the United States, some level of routine sewer system evaluation is cost effective for all of the nation's sewer systems. Experience over the past 15 years has shown that rehabilitation cost are significantly less than replacement costs in most instances. As shown in Chapter 6, rehabilitation costs are 20-25 percent of replacement cost for specialty concrete, cement mortar, and epoxy coatings; 60-80 percent of replacement costs for grouting; and 55-85 percent of replacement costs for sliplining and inversion lining. Comprehensive sewer system surveys including cleaning and inspection are 5-7 percent of sewer replacement costs. Given the fact that comprehensive sewer system evaluation plus rehabilitation costs are 25-92 percent of sewer replacement costs, sewer system evaluation and rehabilitation is extremely cost effective in maintaining the capital asset value of this infrastructure system.

This cost advantage is in addition to the benefit of maintaining existing flows and future capacities due to reduction of infiltration and inflow. The highest benefit/cost ratios are found in areas where the sewer corrosion potential is the highest.

Deterioration rates in systems due to corrosion have been shown to decrease sewer life times from the normal 30-50 years to as low as 2-4 years in extreme cases and 9-14 years in moderate cases.

3.4 Methodology for Preliminary Sewer System Analysis

3.4.1 Sources of Information and Preliminary Methods of Analysis

The extent of the preliminary sewer system analysis depends on the size of the system and the amount of information available. A diagram outlining the major steps to be taken in a preliminary survey is presented in Figure 3-1. Each of these steps are discussed below.

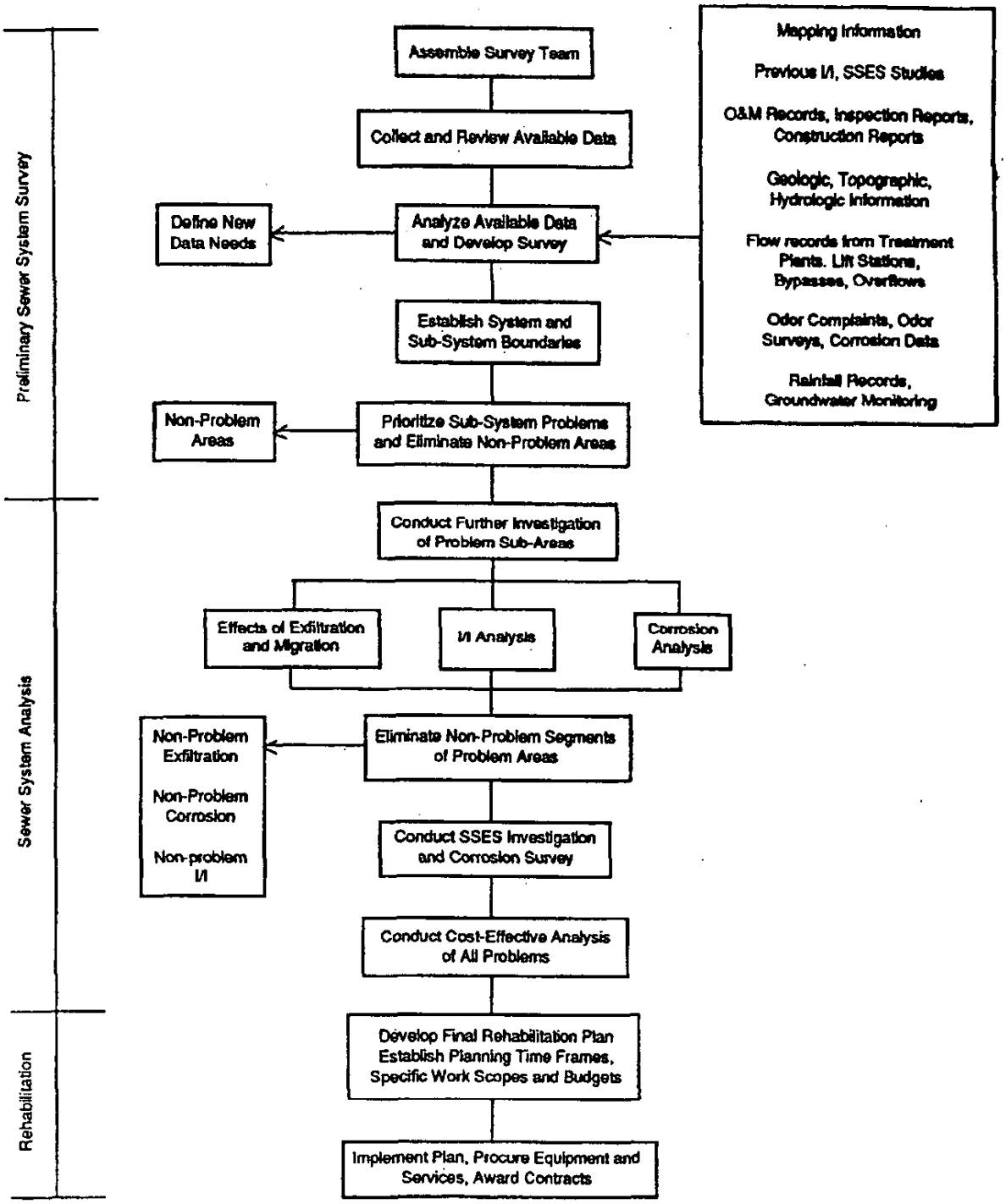
A preliminary sewer system survey is normally conducted by municipal personnel and their consultants. The first step in the procedure is to assemble the survey team. The team usually consists of the city's consultants, representatives from the city or municipal administration departments, central engineering staff, sewer and wastewater superintendent, and key sewer system operating and maintenance personnel. Other staff that have pertinent knowledge and experience with the major sewer system components should be assigned. It is

Table 3-1. Advantages and Disadvantages of Major Infrastructure Financing Mechanisms

	Advantages	Disadvantages
General fund appropriation	**Administrative:** appropriations reflect current legislative priorities **Equity:** all taxpayers contribute to capital projects **Fiscal:** no debt incurred, so projects cost less during periods of inflation	**Administrative:** infrastructure must compete with other spending priorities each year; cannot plan long-term project around uncertain funding **Equity:** no direct link between beneficiary and who pays, and current generation pays for capital projects that benefit future generations.
General obligation bonds	**Equity:** capital costs shared by current and future users **Fiscal:** bonds can raise large amounts of capital; general obligation bonds usually carry lowest available interest rates	**Administrative:** States often impose debt ceilings and require voter approval **Fiscal:** adds to tax burden, especially if interest rates are high
Revenue bonds	**Administrative:** do not require voter approval and are not subject to legislative limits **Equity:** debt service paid by users fees, rather than from general revenues	**Administrative:** require increased reporting and restricted by Tax Reform Act limitations **Fiscal:** usually demand higher interest rates than general obligation bond
State gas tax	**Administrative:** established structure allows tax increase without additional administrative expense **Equity:** revenues are usually earmarked for transportation, so users pay **Fiscal:** revenues relatively high compared to other user taxes	**Administrative:** revenue fluctuates with use of gas **Equity:** fiscal burdens are not evenly distributed between urban and rural areas **Fiscal:** revenue does not rise with inflation or reflect differences
Other dedicated taxes	**Administrative:** voters prefer dedicated taxes **Fiscal:** provides relatively reliable funding source not subject to annual budgeting	**Administrative:** reduces districts ability to meet changing needs **Fiscal:** major economic downturns can reduce revenues significantly
State revolving funds	**Administrative:** promote greater State independence in project selection **Fiscal:** debt service requirements provide incentives for charging full cost for services; loans can leverage other sources of funds; loan repayments provide capital for new loans	**Administrative:** States bear increased administrative and financial responsibility **Equity:** poor districts cannot afford loans **Fiscal:** repaying loans will mean increases in use charges or taxes

Source-Office of Technology Assessment 1990

Figure 3-1. Approach to conducting sewer system evaluation.



important that all staff assigned be able to commit the necessary time for proper planning and implementation of the survey. The major purposes for conducting a preliminary sewer system survey are to identify, localize and prioritize those areas of the sewer system sub-areas with the greatest potential problems, and to identify the preliminary scope of the subsequent investigations. A preliminary survey is a forerunner to the traditional I/I and SSES procedures. The major sources of information used in the preliminary survey are outlined below:

- As-built sewer maps
- Sewer system operation and maintenance (O&M) records
- Existing geographical, geological, climatological and topographical records
- Existing city or municipal planning documents
- Existing treatment plant performance records
- Sewer system monitoring records such as treatment plant flow records, lift station flow records, overflows and by-passes
- Interview information from public officials and supervisory sewer system O&M staff
- Historical sewer system and treatment plant flow and performance information
- Rainfall and groundwater data
- Water use records
- Population and user history
- Industrial survey information

The more important of the above data sources are: available sewer maps, information from previous I/I and SSES studies, along with system and sub-flow monitoring information. The preliminary information also includes the normal data sources used for I/I analysis including flow monitoring, rainfall, groundwater levels, and anecdotal evidence of exfiltration.

The proper assignment of data collection responsibilities to individuals that have access to the required information, and the organization of responsibilities by the survey team leader is a major factor in the success and efficiency of the preliminary survey.

The goal of this preliminary survey, however, is to utilize the available data to make the best judgments possible regarding the condition of the existing sewer system and to define the specific problems within the system and sub-system areas. The final plan resulting from the analysis of available data should, as a minimum, provide the following information:

- Clear delineation of all sub-areas, and location of monitoring points
- Clear understanding and preliminary ranking of the problems within each sub-area. This may include the relative severity of infiltration and inflow, suspected sources of each, identification of major areas of corrosion, the impact of lift stations on sulfide generation and corrosion, evidence of structural failures, sewer blockages or other damage to the sewer system infrastructure
- Identification of all non-problem sewer sub-areas
- Identification of sewer system monitoring and data needs for all priority problems in each sub-area selected for study
- Schedule for establishing system monitoring requirements. For example monitoring for inflow would be conducted during high-groundwater conditions while monitoring for corrosion or exfiltration would be conducted during low-flow, dry weather conditions.

An estimate of resources needed to conduct the investigation of the sub-systems should include:

- Permanent or temporary sampling and flow measurement equipment
- Sewer cleaning and inspection equipment
- Sulfide and corrosion measurement and monitoring equipment
- Groundwater monitoring needs
- Rainfall simulation equipment

The resource estimate should include a summary of all activities to be conducted by municipal employees and all activities to be completed by contract services. A summary work scope, budget and schedule should be prepared for all service contracts.

The preliminary survey differs from the initial stages of an I/I analysis or SSES investigation in the following respects:

- The scope of the preliminary sewer system survey is broader than I/I or SSES and includes surveys of physical damage to the sewer system infrastructure, capacity limitations, effects of corrosion and sewer system deterioration rates, and excessive I/I, including those areas that would possibly be affected by groundwater migration and exfiltration.
- The preliminary survey establishes the problem priorities for the entire system and sub-systems and defines the overall work scope of subsequent investigations
- The preliminary survey defines the costs, objectives, and time frames for implementing all investigations necessary for a complete infrastructure analysis.

3.4.2 *Monitoring and Equipment Needs for Preliminary Analysis*

The monitoring and equipment needs for a preliminary sewer system survey depend on the size of system or sub-systems under investigation and the schedule for conducting the survey. Sub-systems may vary in size from a few tenths of a square mile to several square miles and may include up to 20 or more separate monitoring stations. The preliminary survey includes flow monitoring at critical junctions, limited physical surveys, preliminary corrosion surveys and information to correlate flows with rainfall and groundwater information.

Although equipment needs vary depending on the size of the sub-system, typical equipment needs for a single sub-system investigation are:

- 2-3 fully automatic recording flow meters
- 1-2 velocity meters
- 1-2 depth sensors
- 2-3 20- to 76-cm (8-30-in) weirs
- 1 metal detector
- pH ORP meters
- Recording DO meters
- Smoke bombs, and a gasoline driven blower (1,500-3,000 cfm)
- Camera and film
- Sand bags and plugs, 20-76 cm (8-30 in)
- 60-90 m (200-300 ft) of fire hose and fluorescent dye
- 1-2 tipping bucket rain gauges
- 2 proportional samplers and sample containers
- Device for measuring corrosion such as a sonic caliper
- 1 extendable penetration rod
- 4-6 sulfide test kits
- Miscellaneous sewer and manhole sampling and access equipment including ladders, lights, buckets, sample containers, rope, tapes, hand tools, and safety equipment

Of the above equipment, selection of the appropriate flow measuring devices (flow meter or weirs) and the equipment for the preliminary corrosion survey is the most important. The above list does not include preparatory sewer cleaning or TV inspection equipment since the preliminary survey does not extend to that level of detail.

3.5 Infiltration and Inflow Analysis

3.5.1 *Introduction*

Infiltration is that volume of water that enters sewers and building sewer connections from the soil through foundation drains, defective joints, broken or cracked pipes, faulty connections, etc.[4]

Inflow is that volume of water that is discharged into existing sewer lines from such sources as roof leaders, cellar and yard area drains, commercial and industrial discharges, drains from springs and swampy areas, etc.[4]

I/I is the major deterrent to the successful performance of a wastewater conveyance or treatment system.[5] Excessive I/I in a sanitary sewer system can hydraulically overload sewer lines and wastewater treatment plants, resulting in surcharging, basement backups, sewer bypasses, and reduced treatment efficiency.[6] It also adversely affects the urban environment and the quality of the water resources. Some detrimental effects of I/I are: utilization of sewer facility capacity that could be reserved for present sanitary wastewater flows and future urban growth; need for construction of relief sewer facilities before originally scheduled dates; surcharging and backflooding of sewers into streets and private properties; bypassing of raw wastewater at various points or diversion into storm drains or nearby watercourses; surcharging of pump stations resulting in excessive wear on equipment, high power costs, bypassing of flows to adjacent waterways, diversion of flow away from secondary or tertiary treatment stages, or bypassing of volumes of untreated wastewater into receiving waters; and increases in the incidence and duration of stormwater overflows at combined sewer regulators.[7] Proper analysis of I/I is thus required to demonstrate possibly excessive or nonexcessive flows in a sewer collection system and to identify sources for later correction.

Correction of infiltration in existing sewer systems involves:

- Evaluation and interpretation of wastewater flow conditions to determine the presence and extent of excessive extraneous water
- The location and measurement of such infiltration flows
- The elimination of these flows by various repair and replacement methods; and
- A diligent, continuous maintenance and monitoring program.

Correction of inflow involves:

- Discovery of locations of inflow, determination of their legitimacy, assignment of the responsibility for correction of such conditions
- Establishment of inflow control policies where none have been in effect; and
- Institution of corrective policies and measures backed by monitoring and enforcement procedures.

Control of I/I in all existing and new sewer systems is an essential part of sewer system management. A sewer

system cannot be rehabilitated and then be expected to never develop additional points of I/I. Proper preventive maintenance programs must be established to monitor and control excessive I/I as an integral part of the rehabilitation program.

The procedures involved in conducting an I/I analysis should be listed as an orderly sequence of tasks. Step-by-step actions should be designed to explore the scope and details of the problem.[5] This exploration will ascertain the need and the techniques required for the subsequent evaluation of causes, effects and corrective actions. Information must be gathered for making separate cost estimates for transportation and treatment of the infiltration and inflow components versus elimination through corrective action. Figure 3-2 provides the sequence of events that should be considered to properly analyze and reduce I/I. If this initial analysis indicates that the I/I is excessive, the next phase should be the SSES, which should determine the specific locations of inflow, flow rates, and rehabilitation costs for each I/I source. In general, the main goals of an I/I analysis report are to:

- Identify which sewer systems have reliable data available to conclusively demonstrate nonexcessive or excessive I/I.
- Generate sufficient flow data and characteristics of the sewer system to enable a sound engineering decision to be made regarding excessive and nonexcessive flow.
- Obtain realistic cost estimates for rehabilitation of sewers that contain excessive I/I and compare these costs to the cost of transporting and treating extraneous water.
- Enable the engineer, in the event of excessive I/I, to detail the work tasks for the new evaluation i.e., the SSES.

I/I analysis thus provides the fundamental evaluation and indication of the existence of excessive flows in sewer lines.

3.5.2 Preliminary Information Needed

Prior to conducting an I/I analysis, all pertinent information and data should be collected on the specific wastewater treatment and collection system under investigation. This preliminary information should be enough to allow the investigator to make a judgement of nonexcessive or possibly excessive I/I.[6,7]

3.5.2.1 Interviews

Much of the basic data required for the I/I analysis can be obtained from local sources by carefully planned and executed interview programs. It is generally found that the people who are most familiar with the sewer system are public officials (both present and retired) and local residents who will know from experience where many defects may be located, where hidden interconnections exist, what the history of performance has been, and what the community's planning and growth needs have been and will be. They know both permitted and non-permitted points of flow into sewers as well as the applicable regulations for plumbing and sewer connections.

Results from well-conducted interviews may save the engineer considerable field work and also give a clear overview of the problems to be faced. The results from the interviews may be utilized along with other findings to make a proper judgement as to the seriousness of the I/I problem in the study area, the major problem areas in the system, the percentage of the I/I which can possibly be removed, and the areas which may require further investigation. A specific interview pattern and form is used by many consultants and municipal officials; this form includes a broad spectrum of subjects, such as:

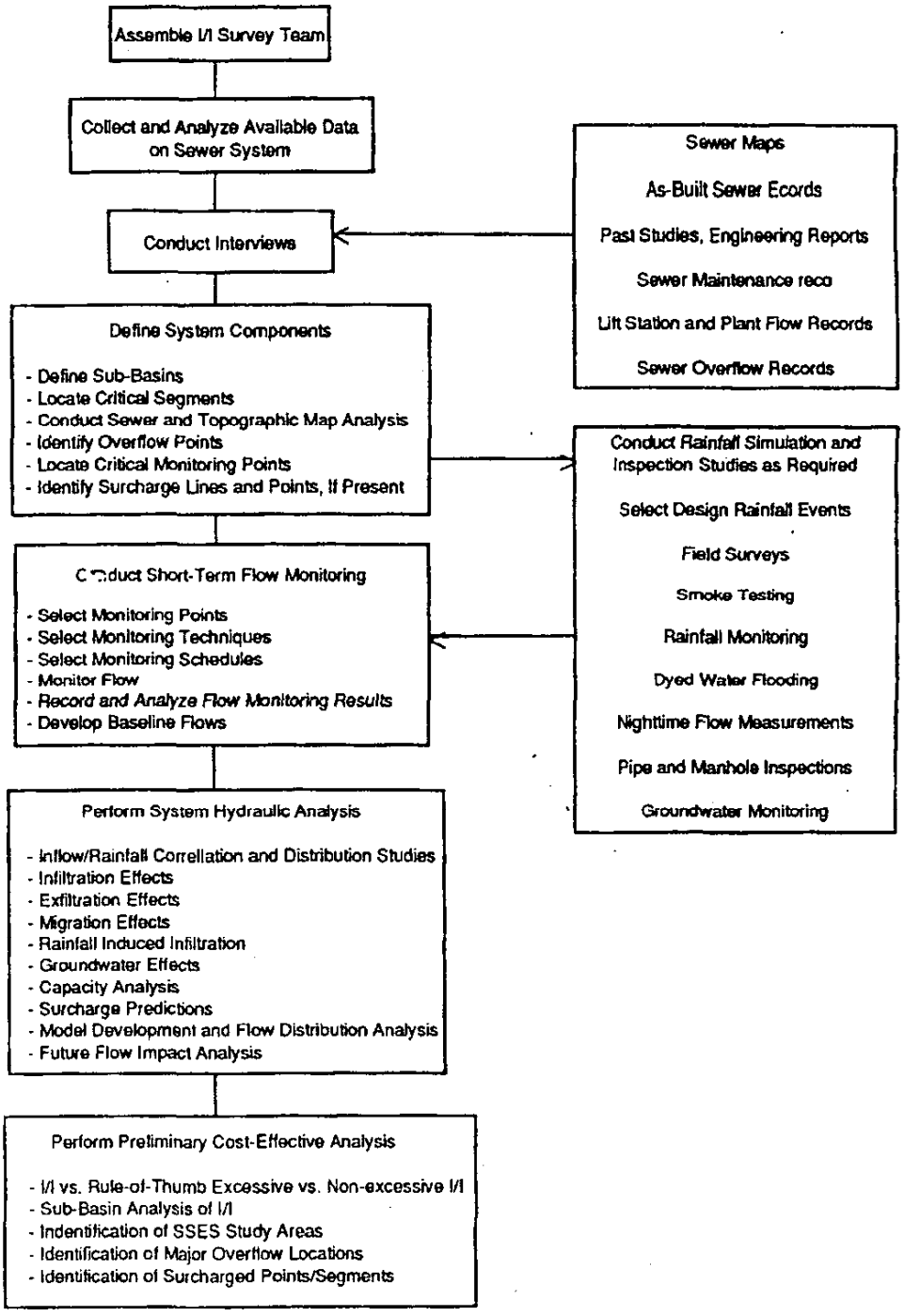
- Sanitary sewer system
- Storm sewer system
- Existing and historical sewer maintenance program
- Problem areas in and around the sewer system
- Geological and geographical conditions in the sewered area
- Population and water consumption data
- Legal and jurisdictional aspects of the sewer system.

A thorough interview form is included in the *Handbook of Sewer System Evaluation and Rehabilitation*.[4] This interview form should be used as a guide and should be adapted and/or modified to the system under study.

The purpose, nature and significance of the study should be explained to the individuals being interviewed to avoid any misunderstandings and to obtain full cooperation. Good public relations should be practiced at all times. Before an interview, maps of the study area should be studied by the interviewer to become familiar with the area. This will enable the interviewer to mark important information on the maps to supplement the description recorded in the interview forms.

Summary information from the interview should be plotted on the map for easy identification. Discrepancies among interviewees and/or between the interview results and existing records should be evaluated. Some spot checking should be performed to substantiate the interview results. From the analysis of the collected information, a plan of action can be made to gather more data needed for the completion of the I/I analysis.

Figure 3-2. I/I analysis major activity flow chart.



The patterned interview involves the first look at the extraneous water problem in the community. A professional who is experienced in the area of I/I should interview everyone who is or has been connected with the sewer system. Subsequent analysis of the data will answer questions and give the analyst a feel for the overall problem. The general objective of the interview is to focus on the more important problem areas. The questions should cover a broad spectrum of subjects, ranging from technical matters to municipal performance capabilities as well as questions regarding the socio-economic profile of the city. A well-planned interview also helps the municipality to think about its problems in an orderly fashion and to recognize alternate methods for solution.

3.5.2.2 Mapping and Map Analysis

a. Mapping

- All sewer lines and appurtenant structures should be recorded on authenticated maps. As-built drawings should be available for all new sewer systems and some of the older sewers.

b. Updating or preparation of maps

- Augmentation of existing maps with details of new construction and revisions
- Preparation of new maps from as-built records, additional underground surveys and other data
- Sewer maps, as a minimum, should be drawn to scale and should indicate sewer sizes, slopes, direction of flow, manhole locations, as well as other major sewer system elements, e.g., pumping stations, treatment plants, bypasses, points of overflow, force mains, force main discharge points, etc.

In sewer systems where sewer maps are available, it may be advisable to verify some of the critical points in the field before total acceptance. Sewer maps should also be updated to include new sewer extensions, sewer line changes, buried manholes, and any other pertinent data.[7]

In systems where maps are not available or are incomplete, they must be developed before the study can continue.

A street map is generally useful for the preparation of a sewer map. In cases where street maps are not available, a schematic layout of the sewer system may be suitable, or a map may be developed. Sewer location and direction of flow can also be determined by dye tracers, floats, smoke, metal detectors and interviews with people having considerable knowledge of the sewer system.

c. Map Analysis[4]

Map analysis normally includes the following elements:

- Establishment of rational major sub-basins based on system layout, drainage areas, main sewers and tributary lines, system configuration and other local factors and system conditions
- Determination of sub-sections when and where they are required to cover a more detailed study of conditions in specific parts of any sub-basins
- Preparation of sewer system flow diagrams and flow sheets
- Selection of key junction manholes for monitoring and gaging flows in each sub-basin which will reflect I/I conditions in constituent parts of the sewer system

Based on the sewer maps, the following information pertinent to I/I can be indicated and overlaid on the sewer maps:

- Topography of the study area
- Soil and hydrogeologic formations
- Groundwater mapping
- Sewer age, type, and size
- Known or potential problem areas such as areas subject to flooding during rainfalls, surcharged sewers, overflowing manholes, overloaded pumping stations, houses with sewer backup problems, obvious inflow sources, existing and historical swampy areas, etc.

This information, along with the sewer maps, may enable one to gain valuable information into the I/I problems of the area such as:[7]

- Storm sewers crossing, parallel to, or in the same trenches as the sanitary sewers are likely I/I sources
- Sewers constructed near rivers, streams, ditch sections, ponding areas and swamps may present serious I/I problems due to groundwater seepage or direct drainage.
- Sewers constructed in unsuitable soils that may be subjected to settling resulting in open joints and/or cracked piping
- Older sewers or ones of particular materials, joints or construction practices may present greater potential for I/I. Manholes with perforated covers may present serious inflow problems in low lying street areas.
- Sewers constructed above seasonal high groundwater level should present few infiltration problems.

3.5.3 Rainfall Information

3.5.3.1 Sources of Information and Methods of Analysis

The measurement of precipitation as a part of sewer system evaluation is undertaken to correlate rainfall with flow metering data. Several items are generally of interest: rainfall intensity, total volume per event, and duration of the event. These data can be obtained from tipping buckets or continuous weighing rain gauges. Charts that record rainfall for several events and a totalizer that provides a check against recorded data is useful. Snow melting devices for colder climates are also available with the precipitation measuring devices. Less sophisticated devices such as graduated cylinders may also be appropriate to provide crude, supplemental information in some cases.

Prior to the implementation of a precipitation measurement program, other less site-specific data should be obtained and evaluated. Sources of precipitation data are the National Oceanic and Atmospheric Association (NOAA), airports, state weather observers, electronic media weather observers, other public works and research agencies and private citizens. NOAA has an extensive nationwide network of recording rain gauges. Those gauges with hourly rainfall data are summarized by state in a monthly publication entitled *Hourly Precipitation Data*. Another useful publication containing daily precipitation quantities from NOAA stations is *Climatological Data*, which is also published monthly for each state.

Rainfall causes inflow and can also cause infiltration by the following mechanisms:[6]

- Rainfall and/or surface run-off may be carried directly through the cracks in a clay soil surrounding shallow sewer lines and manholes and leak through the deteriorated manhole walls and sewers to cause an infiltration problem.
- During and immediately after heavy rainfall, the rainwater reaches the groundwater by percolating through overlying soils and causes an increase in groundwater level. The amount and rate of piezometric head increase is a function of the soil type and structure. This increases the potential hydraulic head. If the level is above the sewer pipes it increases the driving force, which can cause the water to enter the pipes through defective joints, etc.
- In locations where the sewer pipes are cut in underlying bedrock, the rainwater, after percolating through the overlying soils, will likely flow in the same trench and thereby cause an increased infiltration problem in the sewers.
- During heavy rainfalls, another phenomenon may occur in the soil and increase the infiltration rate in the sewers. This is the case when a large ground surface is covered by impounded rainwater: as this large blanket of impounded water percolates through the soils underneath, it leaves little chance for the air in the soil to escape. Because of this, the air is subjected to increased pressure. The pressure is transmitted to the groundwater above the sewer pipe and may cause an increased infiltration rate through defective pipe joints, etc.[3]

3.5.4 Topographic and Geologic Information

3.5.4.1 Sources of Information and Method of Analysis

Soil conditions in the sewer system study area often affect the I/I problems. Sewers constructed on unsuitable soils may be subjected to settling, expansion, or contraction resulting in open joints or cracked pipes. Soil chracteristics that affect I/I response are:[4]

- Permeability, among other soil characteristics, affects the rate of movement of groundwater through the soil matrix adjacent to sewers and sewer trench backfill materials.
- Backfill and bedding materials immediately surrounding the sewer affect the structural integrity of sewers. Granular sewer bedding materials are quite porous and often act as a secondary conduit that transmits groundwater along the sewer line thus providing additional opportunities for infiltration at downstream locations.
- Impermeable soils such as clays that are used as backfill above the granular bedding layer reduce the vertical penetration of surface waters entering the sewer envelope.

Information on soil distribution and soil characteristics in an area can be obtained from the following sources:[7]

- Soil Conservation Service, U.S. Department of Agriculture. The Soil Conservation Service has published many soil maps with descriptions of soil characteristics. They have offices in most counties throughout the country.
- Boring logs in sewer construction contract documents. Boring logs contained in the sewer construction contract document provide certain details about the soils along the sewer construction route.
- State Agricultural Extension Service. Data on soil types and soil characteristics may have been collected by the State Agricultural Extension Service.
- Local Construction Companies or Contractors. Local construction companies or contractors, particularly well drilling firms, should have some information about the area's soils.

- Field Investigation. For locations where no soil information is available or existing information is contradictory or indicative of serious problems, a field soil study may be needed. The study may include the test borings at key points and interpretation of the collected soil samples. For complex and unusual cases, the soil samples should be interpreted by a soil scientist. Assistance may be available from the Soil Conservation Service, Agricultural Extension Service representatives, consulting soil scientists or agronomists.

3.5.5 Ground Water Information

3.5.5.1 Sources of Information and Methods of Analysis

Information is required to determine the variations in the groundwater level. Most of the infiltration phenomena in sewers are groundwater related. Determination of infiltration in the sewer system should be based on a comparison of the wastewater flow data collected in the high groundwater periods with data collected in the low groundwater periods. Sewer line inspections should be conducted during high groundwater periods. Groundwater monitoring should be conducted if no data are available. The level and, in certain cases the chemical characterization of the groundwater affect the degree of infiltration in the sewers. General groundwater information can be obtained from a number of sources:[4,7]

- State Water Resource Agencies
- U.S. Geological Survey
- Local or County Water Conservation Districts
- Groundwater users, including municipalities, water companies and individuals
- Local construction companies or contractors

Two types of groundwater level measurement gauges are commonly used for sewer evaluation studies: the manhole gauge and the piezometer. The manhole gauge shown in Figure 3-3 is used to determine groundwater levels adjacent to manholes. These gauges are inexpensive and fairly easy to install; however, they do clog easily from mineral deposits. The piezometer shown in Figure 3-4 is generally installed in a hole excavated by a powered flight auger. Piezometers are more permanent and are far less prone to clogging. They are also more expensive, but with proper maintenance should last for years and provide higher quality data than manhole gauges

Installation sites for groundwater gauges should be away from underground utilities and streets to prevent damage from street maintenance equipment. Groundwater levels can be recorded on a periodic basis. A plot of groundwater levels versus time is helpful in interpreting meter data and determining levels of infiltration. The recorded data obtained from groundwater gauges should be reviewed and screened carefully before being used. Pumping water from nearby wells may cause a temporary drawdown of the groundwater surface at the monitoring stations, which may give biased groundwater levels. Groundwater levels should be measured during periods of the day when groundwater pumping in the study area is at a minimum.

3.5.6 Baseline Sewer Flows

3.5.6.1 Population and Flow Projection Methods

Population and flow data are essential for the determination of I/I. They determine the theoretical (or base) wastewater production rate in the study area. The theoretical wastewater production represents the total quantity of wastewater including domestic, commercial, and industrial wastewater flows, but excluding all infiltration and inflow. Flow rates are expressed as gal/capita/day (gpcd).

Monitoring of flows at treatment plants, lift stations, and properly located junction manholes is essential. Flow monitoring should be carried out at different times of the day as necessary to permit differentiation between normal expected sanitary flows and I/I volumes. Treatment plant and lift station flow records should be evaluated and necessary information should be gathered to produce an adequate I/I analysis. The baseline sewer flow monitoring tasks should include the following:[4]

- Verify flows from plant records, pumping or lift station charts or log sheets, or from previous sewer monitoring at the same or nearby locations involved in the current analytical procedure.
- Gauge flows at key junctions, manholes, pumping stations and overflow points during hours of minimal flow to determine the presence and amounts of infiltration volumes in various subsections of the sewer network.
- Determine daily and hourly flow variations in a limited number of locations for the purpose of monitoring the effect of rainfall on the flow characteristics in various sub-systems and to ascertain the quantity of infiltration and inflow and to differentiate between the two components.

The population data should be gathered only for the periods in which records for water consumption, wastewater flow, groundwater and rainfall are all available. Both the total population and the sewered population should be known for the determination of I/I. In areas where there are seasonal fluctuations in populations, a detailed breakdown of the population according to season

Figure 3-3. Static groundwater gauge installation elevation.

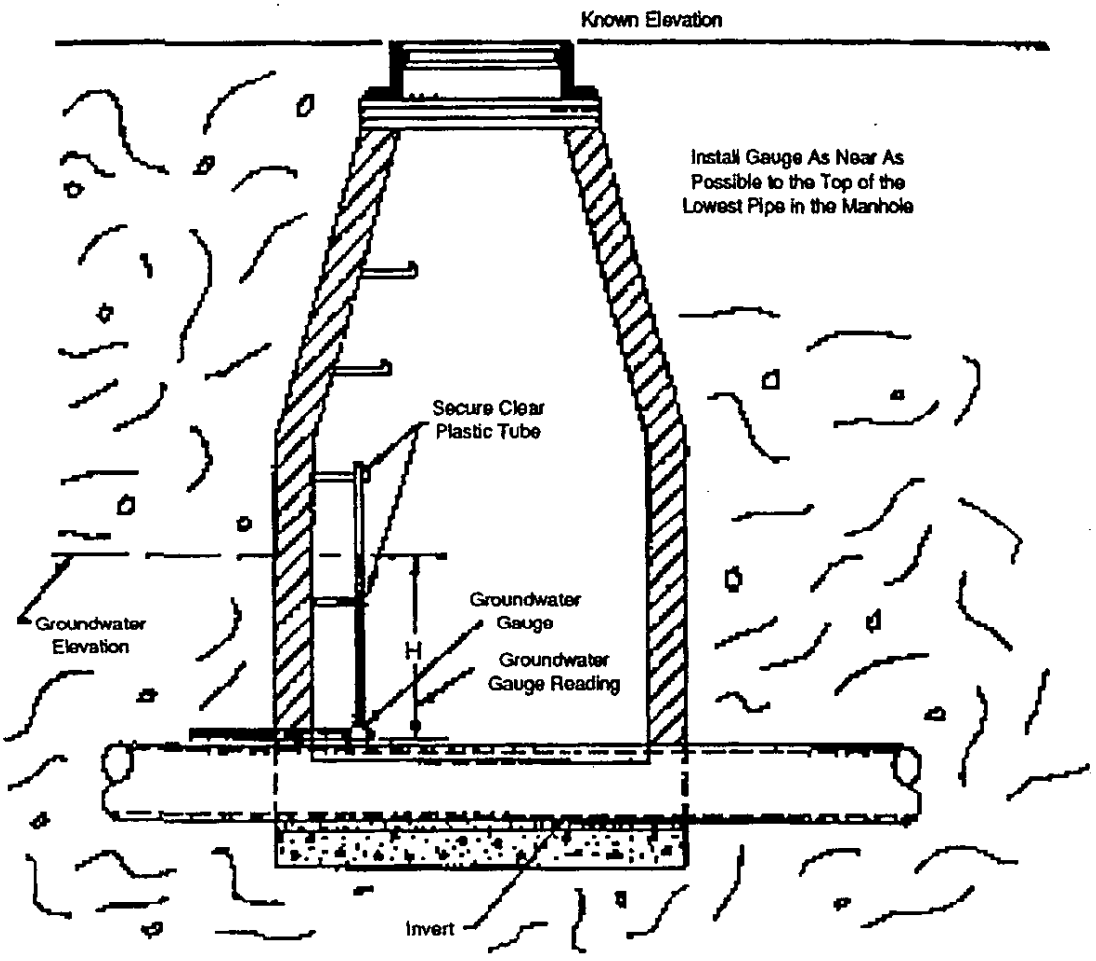
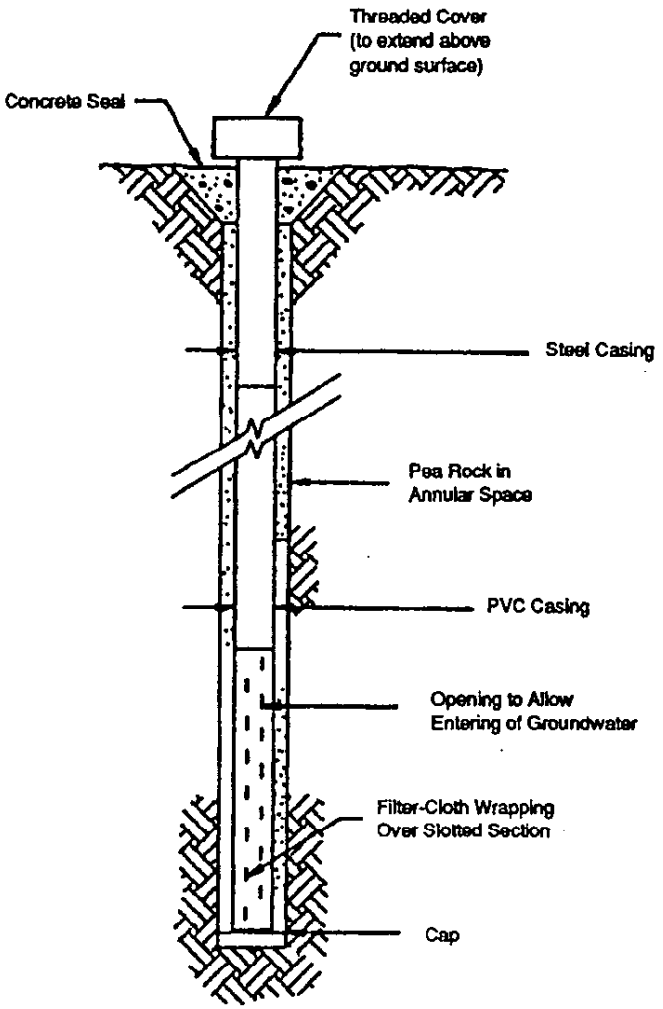


Figure 3-4. Groundwater gauge installation detail.



or month should be provided. Population records are available from the U.S. Census Bureau, local government offices and sanitary districts. Such data may also be reported in previous engineering study reports. If no data are available, a physical survey to include census, house count, and aerial maps may have to be performed to determine the population.[6,7] Preference should be given to wastewater flow records. All water use does not end up in the sewer. Water consumption (metered) is also measured on a cumulative basis (e.g., 100 cu ft/mo).

3.5.6.2 Water Use and Wastewater Generation Estimates

The water consumption data to be obtained should coincide with the available records for wastewater flow, groundwater and rainfall. Metered water data available for all users in the study area should be collected and used for the estimation of the wastewater production rate. Water consumption records can usually be obtained from local water departments, private water companies, industrial plants and individual well users. Water consumption estimates can be made based on population and an inventory of the residential, commercial and industrial establishments in the study area using typical water use rates. Water production records can also be used where water consumption data are not available. If water production data are used, allowances for consumptive use should be made so baseline wastewater flows are not overstated.

Wastewater flow records covering the entire sewer system over a period of 1-2 years should be used for I/I analysis. These records should include and represent groundwater and rainfall conditions in the study area. For larger sewer systems, flow records may have to be gathered from more than one treatment plant, pump station or flow measuring station in the system. Flow records for overflows, bypasses and emergency pumping should be gathered for the I/I analysis. Wastewater flow records can be obtained from wastewater treatment plants, sanitary districts or sewer departments in local governments.

The water consumption and wastewater flow records should be checked for accuracy before being used. The accuracy can be determined by checking the accuracy of the instruments used for recording and totalizing the flows.

3.5.7 Analysis of Infiltration and Inflow

3.5.7.1 Purpose of Analysis

Proper analysis of the data to determine I/I flow rates into the sewer system is essential for accurate estimation of the effectiveness of sewer rehabilitation. Discrepancies between estimated and actual I/I reductions are likely if improper I/I analysis occurs. Establishing the quantities of I/I entering a collection system is far from being an exact science. I/I analysis should consider various inaccuracies of flow measurement in sewer systems. The procedures for interpreting I/I data should recognize the impact of rainfall events, groundwater levels, antecedent soil and weather conditions and monitoring schedules on the overall component flows.

Baseline wastewater flow data are normally collected during dry-weather conditions. Groundwater infiltration should be measured during high groundwater since it will be significantly impacted by groundwater levels throughout the sewer systems. Inflow and RII component flow information are strongly related to the characteristics of the rainfall events occurring during the monitoring period. As discussed in Section 3.5.7.3, RII flows are strongly rainfall dependent even though they do not enter the sewer system directly.

In many cases it is not possible to clearly distinguish inflow, groundwater infiltration and RII. The sum of these components however can be estimated by subtracting the baseline flow from the total flow. These numbers can be used and compared to the accepted rules of thumb of 450 Lpcd (120 gpcd) of domestic plus non-excessive I/I flow and the storm flow of 1,000 Lpcd (275 gpcd). The cost-effective analysis for infiltration and inflow requires that these two components be separated. The cost of transportation and treatment requires that peak flows be determined. A proper cost-effective analysis generally requires that the following flows be determined:

- Peak infiltration
- Peak inflow
- Peak I/I
- Total yearly infiltration
- Total yearly inflow
- Total yearly I/I

3.5.7.2 Groundwater Migration

It is believed that much of the infiltration removed by rehabilitation of a source "migrates" to other sources that were either inactive or less active before rehabilitation. This phenomenon, known as migration, has led to disappointing results in typical rehabilitation programs, which have demonstrated a disparity between anticipated and actual reduction of infiltration.[8]

Sanitary sewer rehabilitation has seldom resulted in the infiltration reduction projected by sewer system surveys. Studies performed at two sites in the Washington Suburban Sanitary Commission (WSSC) sought to determine whether the assumed removable infiltration

migrates to sources which were inactive or less active before rehabilitation.[8] To investigate the impact of migration on rehabilitation, 43 groundwater wells were installed in two study areas with a recording flow meter at each site. Well level readings, nighttime flow, isolation measurements, and local rainfall data were obtained.

After all sewer system defects were inventoried, selective rehabilitation consisting of line and manhole grouting, excavation and repair of sewer segments and grouting of service connections was conducted. Rehabilitation was implemented in two phases in each study area with groundwater and infiltration response measured before, during, and after each phase of rehabilitation. Migration of groundwater infiltration to previously inactive locations was documented at both study sites. This migration effect was accompanied by a corresponding increase in groundwater level at one of the two study sites. Based on an analysis of the data, it was observed that migration effects travelled as much as 60 m (200 ft) to reach unrehabilitated sources. Results of this study indicate that the traditional point source method of I/I analysis is only about half as accurate as it would be if migration were properly integrated.

Migration of groundwater infiltration to previously inactive sources can be documented by a corresponding increase in groundwater level at the study sites. One documented occurrence of groundwater level increasing after rehabilitation is illustrated in Figure 3-5. In this figure, Well 03 was located away from the sewer trench and Well E was located on the trench.[8]

One factor that affects migration phenomena is soil permeability. An important characteristic of existing SSES methodology is the reliance on individual line section nighttime isolation and measurement to identify sewer reaches subject to excessive infiltration. This fragmented approach provides an opportunity for migration since this process identifies conditions at one point in time, eliminating potentially defective elements of the system from further study. To effectively account for migration, the flow monitoring procedure must be revised to expand the data on an individual line segment basis. This will involve initially monitoring sub-areas with extended duration metering.[8]

Migration of infiltration from rehabilitated to unrehabilitated sources was observed and documented under work carried out by the WSSC. The extent of migration was primarily dependent on the number and location of rehabilitated sources in addition to differences in permeability between trench material and surrounding soil. Results of the study by WSSC indicate that rehabilitation should be clustered in areas conducive to migration to achieve net flow reductions. If rehabilitation is not generally concentrated then flow removed from one source would essentially migrate to nearby unrehabilitated sources. General conclusions applied to the WSSC study on migration were:[8]

- Migration is probably not significant for a sewer system constructed substantially below the groundwater level since increases in in-trench groundwater as a result of rehabilitation would probably result in only a minor increase in head compared to the existing head on the sewer system. Interceptors that run along the banks of creeks and rivers are typical of sewer lines below groundwater levels.
- Sewers located in highly granular areas would not be subject to significant migration because groundwater movement would not be restricted by low permeability, thereby allowing exfiltration from the trench.
- Topographically flat areas would be less subject to migration since the lack of steep gradients would result in some outward dissipation rather than exclusive in-trench movement.
- Sewers in soils of low permeability are highly conducive to migration. Despite backfill consolidated during construction the sewer trench would be considerably more permeable than the surrounding soil since sewers are normally supported by granular material such as gravel and sand.

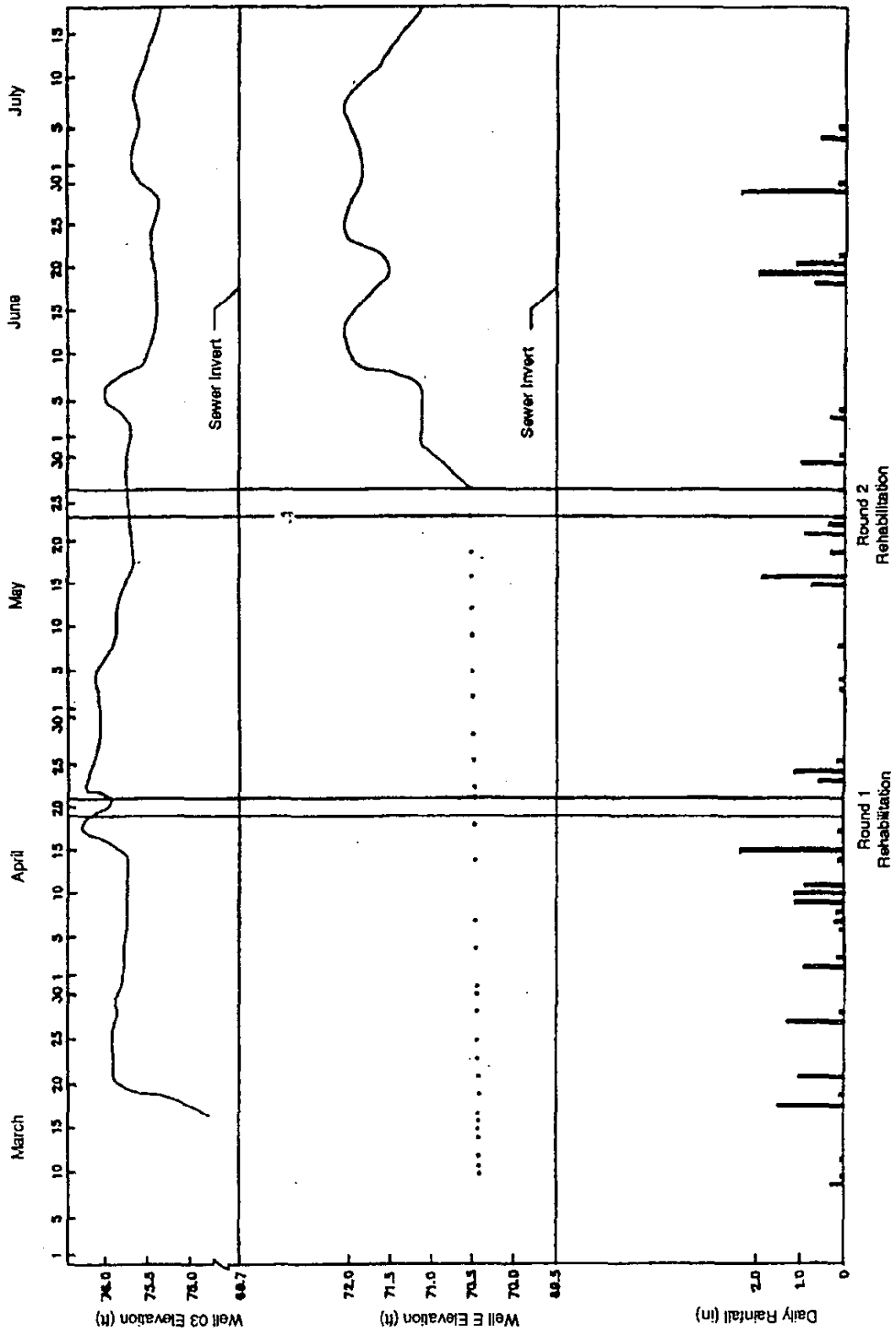
In a comprehensive rehabilitation program, it would be desirable to eliminate sources located on private property, especially house services. Here rehabilitation tends to be more expensive on the basis of unit flow rates. Private sector rehabilitation has political implications when part or all of the rehabilitation is paid by the property owners.

3.5.7.3 Rainfall Induced Infiltration (RII)

Rainfall Induced Infiltration (RII) is a form of infiltration that behaves somewhat similar to and is sometimes confused with storm water inflow. RII generally occurs during or immediately after rainfall events. It is caused by the seepage of percolating rainwater into manhole, pipe, and lateral defects that lie near or are readily reached from the ground surface. Foundation drains are a special case which has been classified as both inflow and infiltration by regulatory authorities. The quick rainfall response of RII causes a more rapid build-up of flow in sewers than normal I/I flows thus creating a greater potential for sewer surcharging and overflow.

An ancillary problem associated with RII as with any infiltration problem is that there is the potential for exfiltration of untreated wastewater at these same pipe and manhole defects. In some cases, discharged wastewater may cause groundwater contamination; in

Figure 3-5. Effects of groundwater on migration.



other cases it might be channelled by sewer trenches to potential points of direct human exposure. Data based on a study conducted by the U.S. EPA indicates the following conclusions and findings regarding the impact of RII:[3]

- RII is a type of infiltration since it enters the sewer system through defects. However, its flow characteristics resemble those of inflow i.e., there is a rapid increase in flow which mirrors the rainfall event followed by a decrease as the rain stops.
- Because of its flow characteristics, RII has occasionally been misidentified as inflow in many cases. Consequently, rehabilitation programs aimed at inflow sources have not achieved the anticipated reduction in extraneous flows in these cases.
- RII appears to represent a significant portion of the flow to some wastewater treatment plants during wet weather periods. In the 10 case studies conducted by U.S. EPA, the peak wet weather flows were 3.5-20 times the dry weather flow. The contribution from RII was estimated to be between 60-90 percent of the wet weather flows, the remainder being groundwater infiltration and inflow.
- Collection and treatment systems often do not have the capacity to handle peak wet weather flows. Peak flows, therefore, can cause wastewater backups into buildings, overflows and treatment system bypasses. Such occurrences are a hazard to public health and a violation of the municipality's discharge permit.
- Sewer trenches can act as collectors of rainfall percolating into the soil. The trenches channel the water, thus providing multiple opportunities for the water to seep into the collection system at defective points.
- The shallow portions of a collection system, e.g. building laterals, manhole defects, etc. are more vulnerable to RII. Interceptors sewers, which are typically deeper, do not appear to be a significant entry point for RII, but are more likely sources of groundwater infiltration, which normally minimizes peak to average flow ratios.
- The extent of RII problems in sanitary sewer systems is related to the age and condition of the sewers, material of construction, pipe, lateral and manhole defects, climate, geology, groundwater levels, and depth of sewers.

Figure 3-6 presents the typical entry points of RII.

3.5.7.4 Method of Analysis

The following techniques can be used to estimate the total infiltration in a sewer system:

a. Water Use Evaluation

This method uses the water supply records for the purpose of estimating the amount of domestic wastewater discharged to the sanitary sewer system. Monthly water use records are obtained. As an estimate, the percentage of the water that would reach the sanitary sewer would range from 70 percent in summer to 90 percent in winter. Given these facts, the rates at which domestic, industrial and commercial wastewater should flow into the sanitary sewers can be determined. These calculated flow rates can be subtracted from the total flow measured at the wastewater treatment plant to obtain an estimate of the infiltration entering the sewer system. Factors that should be considered when using this method for infiltration analysis are:

- Confirmation of the consumptive use mentioned above
- The amount of unaccounted water supplied through the system through wells, springs, or reservoirs that would not be accurately measured due to faulty or inaccurate meters or lack of metering. Unaccounted for water also includes illegal taps and unmetered withdrawals from fire fighting lines, street flushing fire lines, or hydrants.
- For areas supplied with a secondary water system, the water balance must include this source.

b. BOD Evaluation

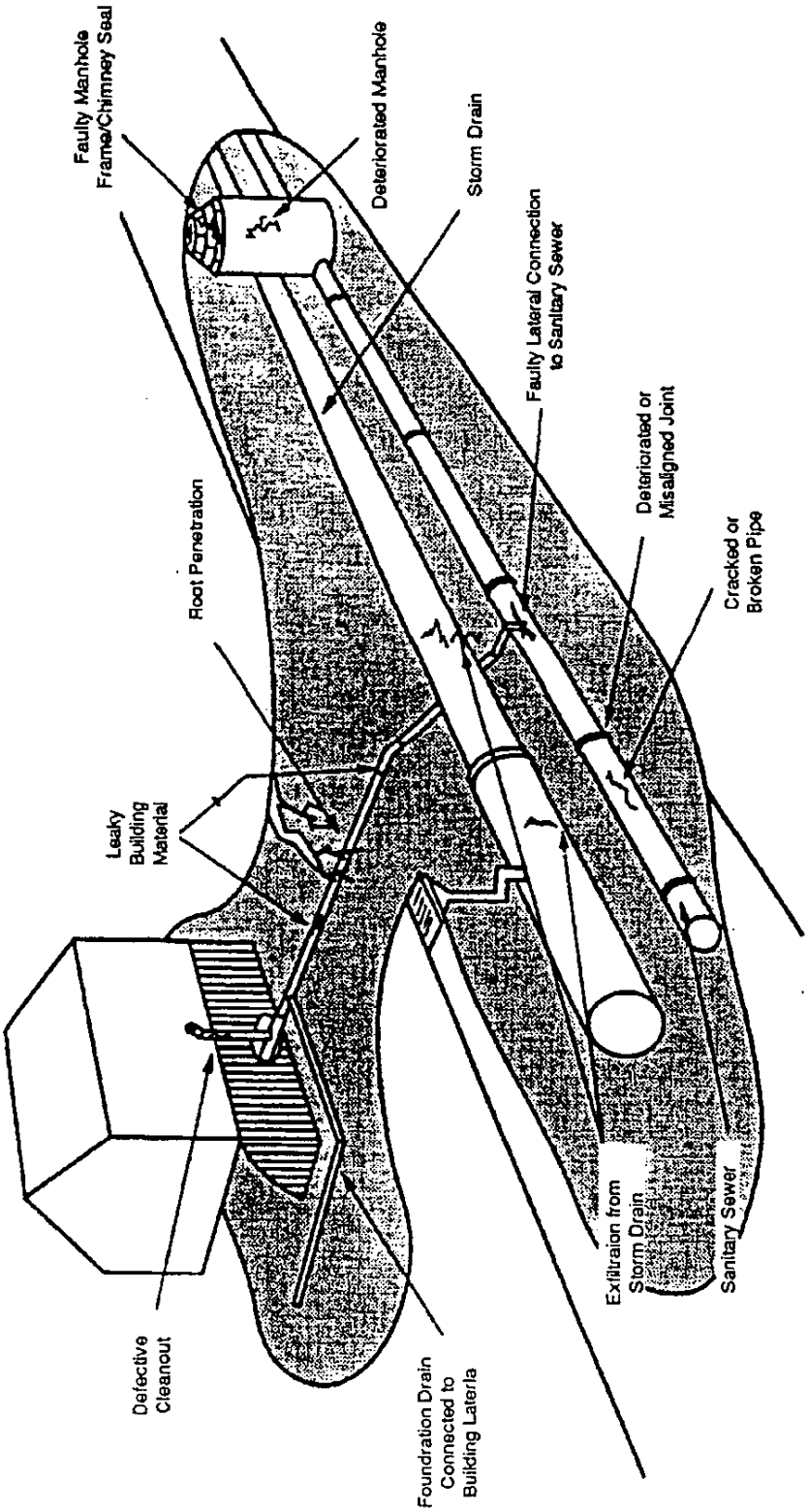
The mass BOD loading from domestic and industrial sources are used in this method. The method assumes that the average BOD of domestic waste without infiltration is 200 mg/L. Monthly treatment plant flow records are used to determine total flow and average actual BOD daily loading. The industrial flow and BOD loading must also be estimated in order to use this method.

First, the total BOD load to the treatment plant is calculated in mass/d from the plant influent flow and actual influent BOD. Next the industrial flow and BOD load is estimated and subtracted from the total plant load. The normal domestic flow is calculated by knowing the domestic BOD load and using an influent BOD concentration of 200 mg/L. The infiltration is then calculated by subtracting the calculated domestic flow plus the estimated industrial flow from the actual plant flow. The procedure can be completed on a daily, monthly or annual basis. The accuracy of the procedure depends on the accuracy of estimating industrial flow and BOD load. It should be applied to the total system rather than to sub-systems because of limitations due to unequal distribution of domestic and industrial flows in smaller sub-systems.

c. Maximum-Minimum Daily Flow Comparison

This method assumes that infiltration will be constant throughout the day if there is no precipitation. Industrial flows are also assumed to be constant throughout the day, so the daily flow variations measured are strictly attributed to the domestic flow contribution. Treatment plant influent data can be evaluated to obtain the domestic

Figure 3-6. Typical entry points of rainfall induced infiltration.



flow rate. The domestic flow rate and the industrial flow rate are subtracted from the total flow rate, which gives the resultant quantity as the rate of infiltration. This procedure can be carried out using monthly averages to obtain the estimated infiltration for the entire year.

d. Determination of Total Yearly I/I

The following procedure is used to estimate the yearly I/I in the sewer system:

- Obtain the average daily, weekly, and monthly wastewater flow data from treatment plants for the time period of interest. A minimum of one year of data should be used.
- Obtain and/or calculate the theoretical wastewater production rates; also the rainfall and groundwater levels throughout the sewer system area should be noted throughout the study period.
- Plot the rainfall duration and intensity along with groundwater levels.
- For each storm, plot the average wastewater flows and the theoretical wastewater production rate as a function of time, as shown in Figure 3-7.
- The area in the plot which is between the theoretical wastewater production rate and the recorded wastewater flow rate represents an estimate of the yearly I/I.

An estimate of yearly infiltration can be estimated as follows:

- Select several months of data from the total yearly I/I plot (Figure 3-7) and plot rainfall duration and intensity, total recorded wastewater flow and theoretical wastewater production rate.
- Draw a line through the lower limit of the recorded wastewater flow as shown in Figure 3-8.
- The distance between this line and the theoretical wastewater production provides an estimate of the infiltration.

Total yearly inflow can be estimated by the following procedure:

- The total yearly inflow can be obtained by subtracting the total yearly infiltration from the total yearly I/I. The total yearly inflow obtained may contain some amounts of infiltration which is induced by rainfall and is known as RII.

3.6 Exfiltration and Its Impacts

3.6.1 Introduction

Exfiltration is a relatively new topic in the sewer system rehabilitation field. Exfiltration occurs when deteriorated or poorly designed or constructed sewer lines allow wastewater to escape from the sewer into the surrounding soil. An exfiltration study was initiated by the U.S. EPA because it was not known what effect exfiltration from sewers had on the groundwater in the area. It was believed that industrial and domestic wastes flowing in the sewers could be escaping into the nearby soil and possibly percolating to the groundwater and contaminating it. *Results of the Evaluation of Groundwater Impacts of Sewer Exfiltration*[10] summarizes the activities and findings of this study. The U.S. EPA study showed that it was impossible to correlate infiltration with exfiltration. Previously exfiltration has been used to estimate infiltration. This practice appears to have limited applicability unless a special case can be demonstrated where such a correlation does exists.

3.6.2 Summary of Information on Impacts

The U.S. EPA study showed that substantial exfiltration does exist in locations where the groundwater level is sometimes or always below the sewer. In fact, in the two field studies which were performed, exfiltration rates were found to be greater than infiltration rates in locations where fluctuating groundwater levels allowed for both infiltration and exfiltration.

As a part of the U.S. EPA exfiltration study, the groundwater was sampled and analyzed in areas where sewer exfiltration existed. The results of the groundwater analyses were inconclusive. Tests performed in one area indicated that exfiltration was not contaminating the local groundwater. Tests in a second area showed slightly higher levels of several contaminants but the study could not prove that these contaminants were a result of exfiltration.

3.6.3 Consideration in I/I Analysis

It is important that the possible effects of exfiltration be considered in an I/I analysis. Ignoring exfiltration could lead to the calculation of inaccurate infiltration rates.

3.6.4 Present and Future Environmental Impacts

Even though the results of the exfiltration study were inconclusive, the environmental impacts of exfiltration are potentially significant. If exfiltration of wastewater is contaminating groundwater, it could have a serious impact on the environment. More research is required before the environmental impact of exfiltration can be determined, but the potential for contamination of groundwater is greatest in coarse soils above unconfined aquifers.

3.6.5 Exfiltration Tests and Methods

Exfiltration tests have historically been used as an indirect method of estimating infiltration potential for both old and

Figure 3-7. **Determination of total yearly infiltration/inflow.**

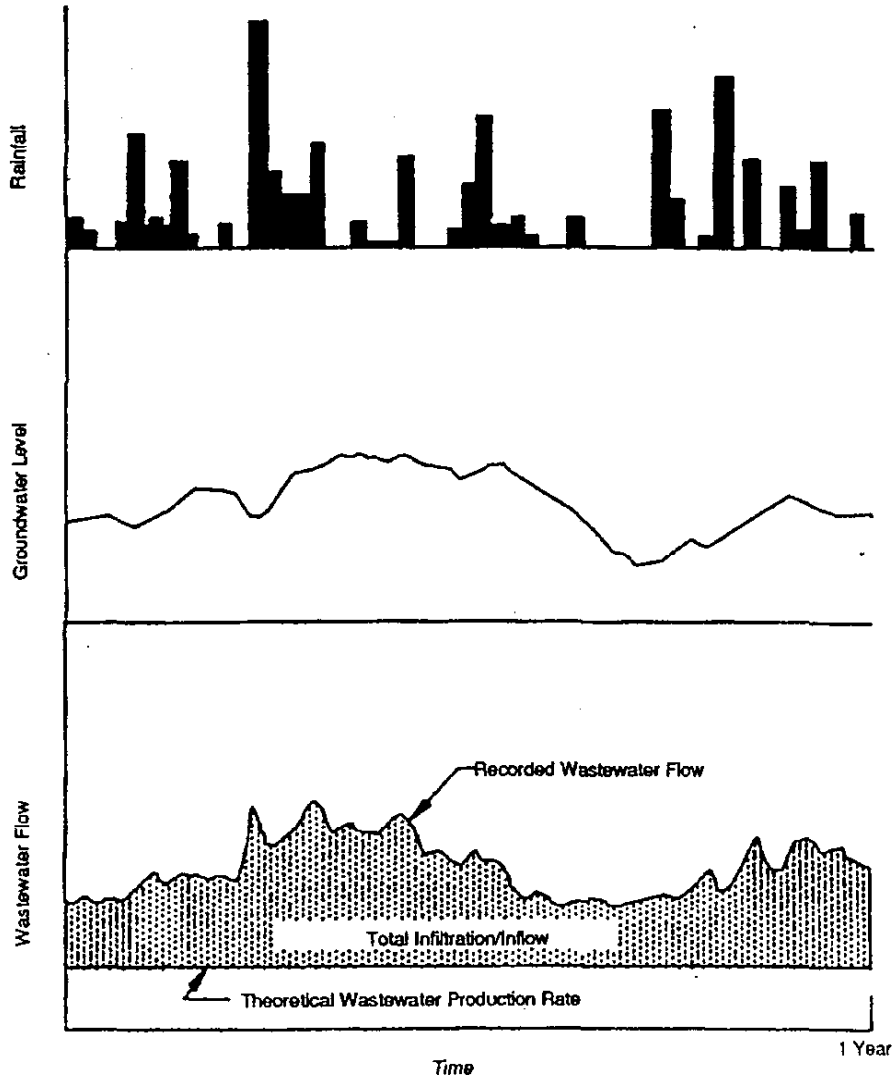
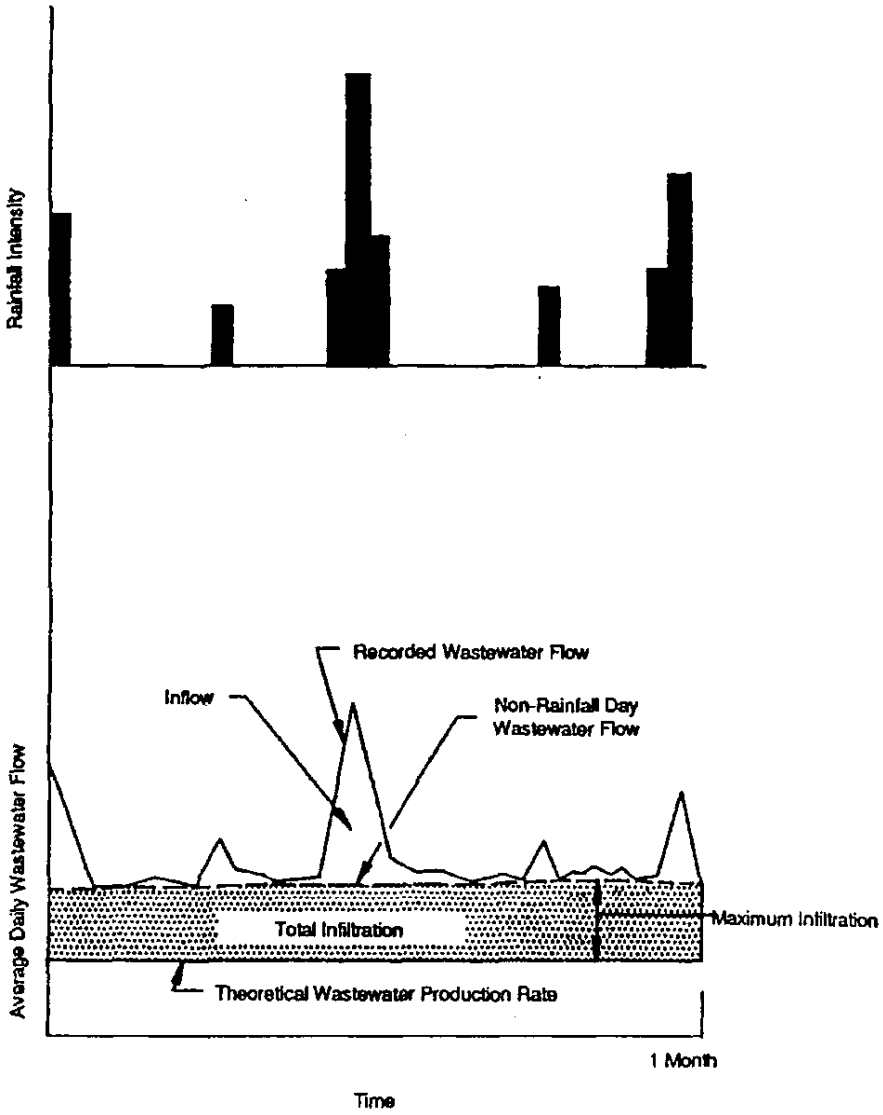


Figure 3-8. Determination of total yearly infiltration.



new sewer systems. It is most commonly applied to new sewers and is normally a part of new sewer construction specifications. Accurate exfiltration tests requires a knowledge of ground water levels, adequate pre-soak times and maintenance of adequate head differentials on the system.

Prior to the initiation of an exfiltration test, the level of groundwater adjacent to each section undergoing the testing must be measured and recorded. The exfiltration test works on the basis that a certain pressure will force water out of the line into the soil surrounding the pipe. The following is an outline of an exfiltration test procedure:

- Clean the pipe section from manhole to manhole for each reach of sewer being tested (applies to old sewers).
- Seal the upstream pipe inlet of the upstream manhole and the upstream pipe of the downstream manhole with plugs to ensure tight seals against water leakage. Since the exfiltration test can take several hours, the need for temporary wastewater bypassing around the test section should be anticipated.

The exfiltration test is based on the loss of water from the section of sewer being tested and thus requires a method of establishing a specific pressure head on the system. The upstream manhole is often used as a reservoir for maintaining the pressure head. A standpipe may be used instead of the upstream manhole for providing the pressure head on the system.

- After properly sealing and isolating the test section, the sewer and manhole or standpipe must be filled with water. The upstream manhole or stand pipe is used to introduce test water into the system and for maintaining an adequate pressure head. The test head should be 60 cm (2 ft) above the pipe crown at the highest point or 60 cm (2 ft) above the groundwater level.
- Water should be allowed to stand in the test section for a period long enough to allow water absorption in the pipe. This time should be as much as 6 hours for concrete pipe depending upon the degree of saturation prior to testing. After the absorption period, the pipe, upstream manhole, or stand pipe is refilled and the test begun. This step is not necessary for vitrified clay or plastic pipe.
- Determination of the actual exfiltration is based upon the method used for providing pressure head on the system, either by standpipe or the upstream manhole.
- Use of the standpipe requires that a constant water level be maintained in the standpipe to maintain the specified pressure head on the sewer section under test. Therefore, the volume of water added to the standpipe over the one hour test period is the actual exfiltration rate from the section under test.
- When using the manhole, the exfiltration rate will be determined by measuring the difference of the final water elevation and the initial water elevation and converting this to actual gallons lost through the pipe in a one hour period.
- If the pipe being tested does not meet the permissible loss, the section of sewer is considered unacceptable. Another exfiltration test should not be conducted until the groundwater conditions surrounding the pipe return to a condition similar to those existing at the beginning of the test period. The groundwater elevation should be determined prior to initiation of the second test.

A less commonly used exfiltration test is the continuous flow monitoring technique. Continuous flow monitoring should be performed in a 300-m (1,000-ft) section of sewer or greater which contains nothing that could interfere with the test results. The groundwater level must be below the sewer to ensure that no infiltration occurs and there must be no laterals or cross connections. Certain characteristics of the test section must be constant for the entire section: the size, type and age of sewer pipe and the type of soil surrounding the pipe. The flow rates at the beginning and end of the test section are continuously measured and the difference between the two is the amount of exfiltration. In the exfiltration study, the flow measurements were made using a weir and differential pressure sensing bubbler flow meter and flows were measured and recorded for at least 48 hours.[5] Other types of flow measurement schemes would also work, based on the same physical principles.

If a 300-m (1,000-ft) section of sewer that meets the above criteria cannot be found, a shorter sewer or one which contains a few disturbances may be used. The effect of the disturbances would need to be measured and analyzed, however, and would introduce significant errors into the calculation of the exfiltration.

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National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

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CHAPTER 4

Sewer System Evaluation

4.1 Introduction

The Sewer System Evaluation Survey (SSES) is the third phase of an overall sewer system evaluation (See Figure 3-1). The purpose of the SSES is to quantify the amount of infiltration/inflow (I/I) and rainfall induced infiltration (RII) that can be reduced and the cost of such reduction on a source-by-source and sub-system basis. The SSES confirms and refines the overall findings of the I/I analysis. The SSES employs TV inspection, rainfall simulation and other techniques to identify specific sources as required to develop the detailed cost-effectiveness analysis for I/I.

The findings of the SSES should be sufficiently specific to describe the corrective actions that need to be taken along with the amount of infiltration, RII, and inflow that will be eliminated from each major source, sewer segment and sub-basin . The SSES must separately define the cost effectiveness of infiltration removal and inflow removal.

Where corrosion is present, the extent of corrosion mitigation expected due to I/I rehabilitation should be noted. Specific corrosion potential should also be defined and recommendations made to reduce this potential to acceptable levels. The procedure for conducting a corrosion survey as a part of an SSES is presented in Chapter 5.

The following tasks are usually included in the SSES:[1-3]

- Survey Planning and Cost Estimating
- Physical Survey
- Rainfall Simulation
- Preparatory Cleaning
- Internal Inspection
- Preparation of Survey Report and Cost Effective Analysis

Table 4-1. Sewer System Testing and Inspection Methods

Method	Application
Smoke testing	Most common routine source detection method to identify inflow and RII sources.
	Source detection after previous lining or replacement.
Rainfall simulation (dye flooding and tracing)	Used after smoke testing to confirm suspected storm drainage connections, and other inflow and RII connections.
Building plumbing inspection	As needed after smoke testing to confirm suspected inflow sources, such as roof leaders and foundation drains.
Manhole inspection	Primary source detection to evaluate I/I sources and structural condition.
	Inspection performed along with other investigation procedures.
Flow isolation	Follow-up source detection after sealing; used to verify migration, identify I/I.
	Used where flow monitoring indicates high infiltration in large areas.
	Used where smoke testing indicates potentially major infiltration sources.
TV inspection	Primary internal inspection technique for SSES, degree of inspection areas for pipes as determined by I/I analysis.
	Routine inspection for pipes rehabilitated by sealing if interim detection does not reveal I/I sources
	Used after grouting and sealing techniques.
	Used to verify smoke testing, flow isolation or when temporary flow monitoring indicates excessive I/I.
Lateral testing	Used where smoke testing indicates major defects
	Used where building inspection indicates major defects.

Table 4-1 describes the most commonly used sewer system testing and inspection methods.

4.2 Planning the Survey and Use of Sub-System Approach

The SSES must be planned and executed to produce accurate estimates of flow reduction and estimated costs. An overall block diagram for the conduct of a preliminary sewer system evaluation plan was presented in Figure 3-1. Figure 3-2 presented the sequence of steps for conducting an I/I analysis. Figure 4-1 presents a diagram of the methodology to be followed in the conduct of an SSES. The following sections of this chapter presents the detailed procedure for an SSES.

The physical survey is performed to isolate the problem areas and to determine the general physical conditions of the sewer sections selected for future study. Rainfall simulation is conducted to locate the rainfall-associated I/I sources in the sewer lines.

Preparatory cleaning of the sewers is necessary prior to internal inspection. Internal inspection locates the I/I sources, the flow rate from each source and the structural defects in the pipe. Finally, the survey report summarizes the results obtained during the survey and presents a cost-effectiveness analysis of the I/I sources which can be economically corrected.

4.3 Physical Survey

The physical survey of the sewer collection system is performed to isolate the obvious problem areas, to determine the general condition of the sewer sections selected for further study. The following tasks are normally included in the physical survey:[2,3]

4.3.1 Aboveground Inspection

This should include the investigation of the general conditions of the study area such as topography, streets, alleys, access to manholes, etc. Potential problem areas, such as waterways, river crossings, natural ponding areas, should also be located. Key manholes are identified for additional flow measurements and groundwater monitoring. Manhole access problems, such as easement, access, buried structures, traffic interferences, should be noted. The accuracy and completeness of sanitary sewer maps should be verified. The proximity of storm and sanitary sewers, inflow sources, such as roof downspouts, yard and area drains, creeks, low or inundated manhole covers and frames, and foundation drains, etc. are all indications that rainfall simulation tests in the form of smoke testing and/or dyed water testing should be planned. A program for uncovering manholes, improving and raising frames to above grade should be planned.

4.3.2 Flow Monitoring

This should include determining and isolating areas where I/I exists. During the I/I analysis, flow monitoring work would have already been performed in a few selected manholes. The additional flow monitoring work performed during the physical survey is actually a continued effort to further reduce the number of areas to be investigated. Flow monitoring should be conducted during the highest groundwater conditions to identify maximum infiltration flow. Monitoring for inflow should be conducted during storm events under wet weather conditions. Dry weather and wet weather flows should be monitored for comparison. To minimize the effects of normal wastewater flows, the flow monitoring should be conducted during the early morning hours. Sub-system and plant flow monitoring should be conducted on a 24-hr/d basis.

4.3.3 Flow Measurement

Flow in sanitary sewer systems consists of base flows, infiltration and inflow. Separation and quantification of these components is the prime objective of flow monitoring. Flow measurement in sewer systems is undertaken to define variations of certain flow components with time or to define peak and/or minimum flow conditions. Sewers should be cleaned thoroughly before velocity measurements are undertaken.

Many techniques are used for the measurement of flows in sanitary sewers. The equipment and techniques selected will depend upon the resources available, the degree of precision required, and the physical conditions within the sewers.

a. Manual Methods

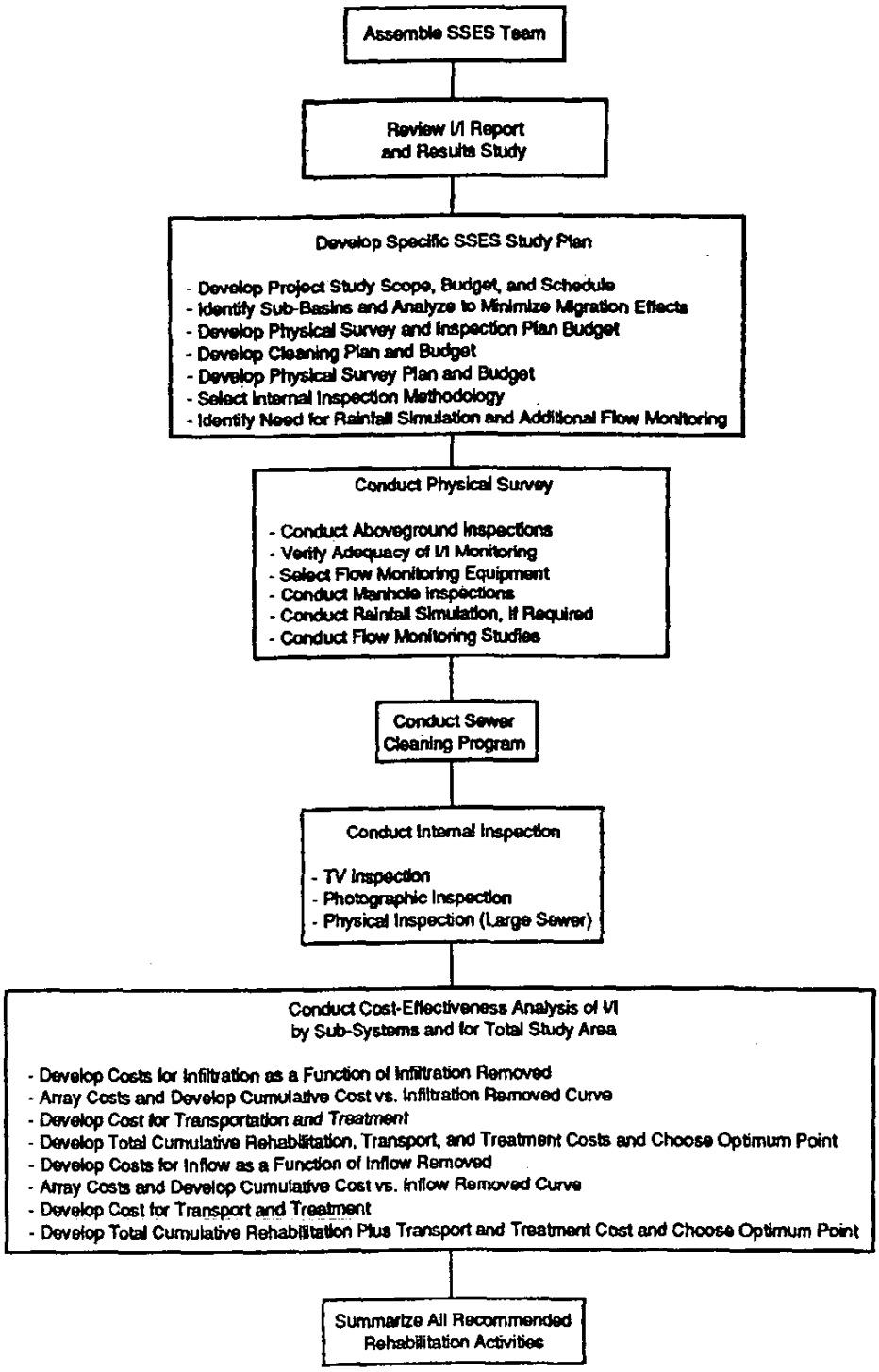
This is the most widely used technique for measurement of instantaneous or short term flow. Generally, the equipment is portable and flows can be determined immediately using published curves, nomographs or tables.

Weirs

The weir is a common device for measuring low wastewater flows because of its ease of installation and low cost. Flow measurements through weirs are obtained by recording the head (water level) above the weir crest and determining flow rates by calculations, nomographs or tables. Advantages and disadvantages of weirs are:

Advantages	Disadvantages
• Low costs	• Fairly high head loss

Figure 4-1. Sewer system evaluation flow diagram.



- Easy to install
- Must be periodically cleaned; must be suitable for channels carrying excessive solids
- Easy to obtain flow by standard equations, nomographs, etc.
- Accuracy affected by excessive flows and debris
- Direct flow reading
- May be difficult to make accurate manual measurements in sewers because of limited access
- Many designs available for flexibility
- Cannot be used in sewers flowing full
- Generally accurate

Additional information on the measurements of flow through weirs is provided in the report *Existing Sewer System Evaluation and Rehabilitation*.[3]

Flumes

Flumes operate on the Venturi principal. In flumes, the constriction of the throat causes the flow to have a critical depth. This is followed by a hydraulic jump if the slope allows subcritical (low velocity) flow. There are several types of open channel flumes, including the Parshall, Palmer-Bowles, H-Flume and Trapezoidal configurations. Flumes are capable of providing results accurate to within 3-5 percent. Advantages and disadvantages of flow measurements by flumes are as follows:

Advantages	Disadvantages
• Self-cleaning to a certain degree	• High cost
• Relatively low head loss	• May be difficult to install
• Accuracy less affected by approach velocity than it is with weirs	
• Data easily converted to flow using tables or nomographs	

Manual Depth Measurement

An instantaneous flow measurement in sewers can be obtained by the following formula: $Q = AV$, where Q is the volumetric flow rate, V is the mean velocity of flow, and A is the cross-sectional area of the pipe. The mean velocity of flow must be measured or obtained theoretically through the Kutter's formula:

$$V = 1.486\ R^{2/3}\ S^{1/2}/N$$

Where,

N = Mannings Coefficient

R = Hydraulic Radius, ft

S = Slope, ft/ft

Staff gauges marked to the nearest 3 mm (1/8-in) are used to measure depth. In manholes that are relatively clean and accessible, the staff gauge may be inserted into the invert of the manhole channel and the depth of flow measured. The depth of sediment in the pipe should be noted and the depth of flow corrected accordingly. Advantages and disadvantages of this technique are as follows:

Advantages	Disadvantages
• Inexpensive	• Instantaneous result that may not be representative
• Rapid results	• Determination of mean velocity is critical
• Ease of operation	• Cannot be used in surcharged sewers
	• Low degree of accuracy

Timed Volume

This method is used to determine flow rates from leaking manhole walls, wet well walls and accessible point sources of inflow. The method involves the use of a vessel of known volume; the time to fill this vessel is measured with a stop watch or a watch. Equipment required for flow measurement by this technique includes plastic containers or 208-L (55-gal) drums, depending on the amount of flow. A stop watch or a watch with a sweep second hand is suitable for measuring time. Advantages and disadvantages to this method are:

Advantages	Disadvantages
• Accurate	• Generally cannot be used for flow in any but the smallest sewer pipes
• Inexpensive	• Not adequate for high velocity flows
• No specific expertise required	

Dye-Dilution Method

This technique is a simple, potentially accurate, and quick method for the determination of flows in sanitary sewers. The method is based on measuring the concentration of dye in a waste stream into which has been added a known concentration of dye, then calculating the flow. Flows can be measured under partial or full flow conditions without entering manholes. This method is employed to obtain instantaneous flow rates but with added equipment it can be used to monitor flow on a continuous basis. Advantages and disadvantages to this method are:

Advantages	Disadvantages
• No entering of manholes	• Samples must be analyzed as soon as possible (most dyes decay in sunlight).
• Saves time and provides instantaneous flow data on many sewer sections	• Temperature correction may be required • Instrumentation is expensive • Dye is expensive
• Independent of sewer site,dimensions, velocity and surcharging	• Need at least 100 sewer diameters for dye mixing before sampling.

Three water soluble fluorescent tracer dyes are extensively used: Rhodamine B, Rhodamine WT, and Fluorescein. For accurate flow measurements in sewers, a dye which has a low sorptive tendency with the solids in the wastewater should always be used. The fluorescence of the Rhodamine dyes is not suitable outside of the pH of 5-10. Since the fluorescence of the dye is also affected by temperature, a correction factor should be applied to the measured concentrations if the temperature of the sample is different than the room temperature.

Commercial solution feeders are available for feeding the dye at a constant rate to the manhole. Collection of the samples at the downstream manholes can be achieved by lowering a container with a rope attached to the sampler. To minimize the loss of dye due to absorption, the sample container should be made of high quality glass or other similar material. The samples should be allowed to stand to reach room temperature and to settle the suspended solids before measurements are taken

b. Automatic Flow Measurement

Automatic flowmeters can continuously monitor flows with a minimum of labor. Data collected can be displayed, recorded on charts, sorted on magnetic tapes or solid state memory, or even transmitted from the field to the office by telephone or radio. These meters save considerable time and effort compared to manually recorded flow data, but proper installation, calibration, and maintenance require individuals with a basic knowledge of hydraulics and proper maintenance procedures for the meter in use. Following are the capabilities of various automatic meters:

Depth Measurement

Depth recorders are used to measure liquid levels in a pipe, head over a weir, depth in a flume, or other applications. Commonly used equipment for recording liquid depths includes probes, bubbler, pressure sensors, floats, ultrasonic devices and capacitance/electronic probes.

Velocity Measurements

Automatic flow monitors that use velocity measurements can provide accurate data even under highly fluctuating liquid levels. Velocity may be automatically recorded using ultrasonic doppler methods, magnetic methods, mechanical current meters, or other methods. In most cases the depth of flow is recorded along with the velocity in order to utilize the flow equation Q = AV.

Electromagnetic/Doppler meters

Velocity measurements by these methods are usually taken by connecting the probe to the outside of the pipe to be monitored. This is generally used for pipes flowing full and having sufficient suspended solids to be transmitted back to the receiver. The advantage to this type of flow measurement is the ability to record flows in closed pipes without obstructing the fluid flows.

Orifice/Nozzle/and Venturi meters

These types of flow meters are used for measuring flows in completely full pipes. The basic concept is to form a constriction in the flow so that the velocity increases and the pressure decreases. The constriction provides an opportunity for solids to accumulate.

4.3.4 Manhole and Sewer Inspection

This task is required to determine the actual condition of the sewer system. Inspection should include descending and examining conditions of manholes and lamping of sewer lines to ascertain sub-system I/I conditions. Each manhole should be numbered and its physical condition noted in log sheets and standardized field forms. Safety precautions should be taken at all times before entering the manholes and proper NIOSH-OSHA procedures and references should be consulted. Sewer inspection should be carried out and identified on the manholes numbered. An inventory of the length, size, type, depth and the general conditions of the sewer pipes provides a basis for the estimation of the amount of work required for the preparatory cleaning and internal inspection. Depth of flow in sewers provides a rough indication of the capacity of the sewer pipe and whether or not I/I is present in the sewer section. Temperature can also be used as an indicator for the detection of extraneous water entering the sewer section being investigated since temperature near the point of entry for extraneous waters will be lower than the average temperature in the sewer lines, if the extraneous source represents a significant portion of the total flow. All the observations made during the manhole and sewer pipe inspection should be recorded in field log sheets and correlated with the sewer maps. Figure 4-2 indicates the typical defects found during manhole

Figure 4-2. Typical manhole defects.

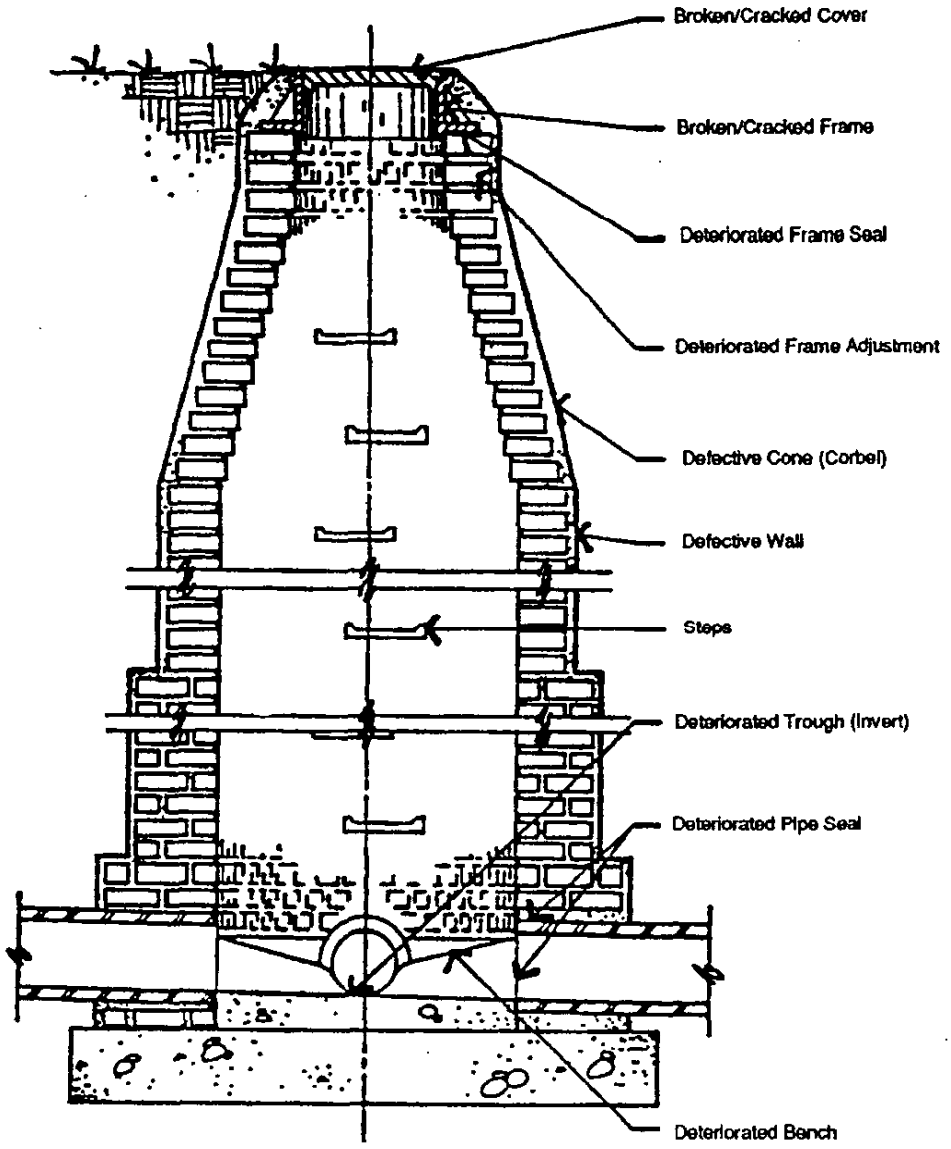
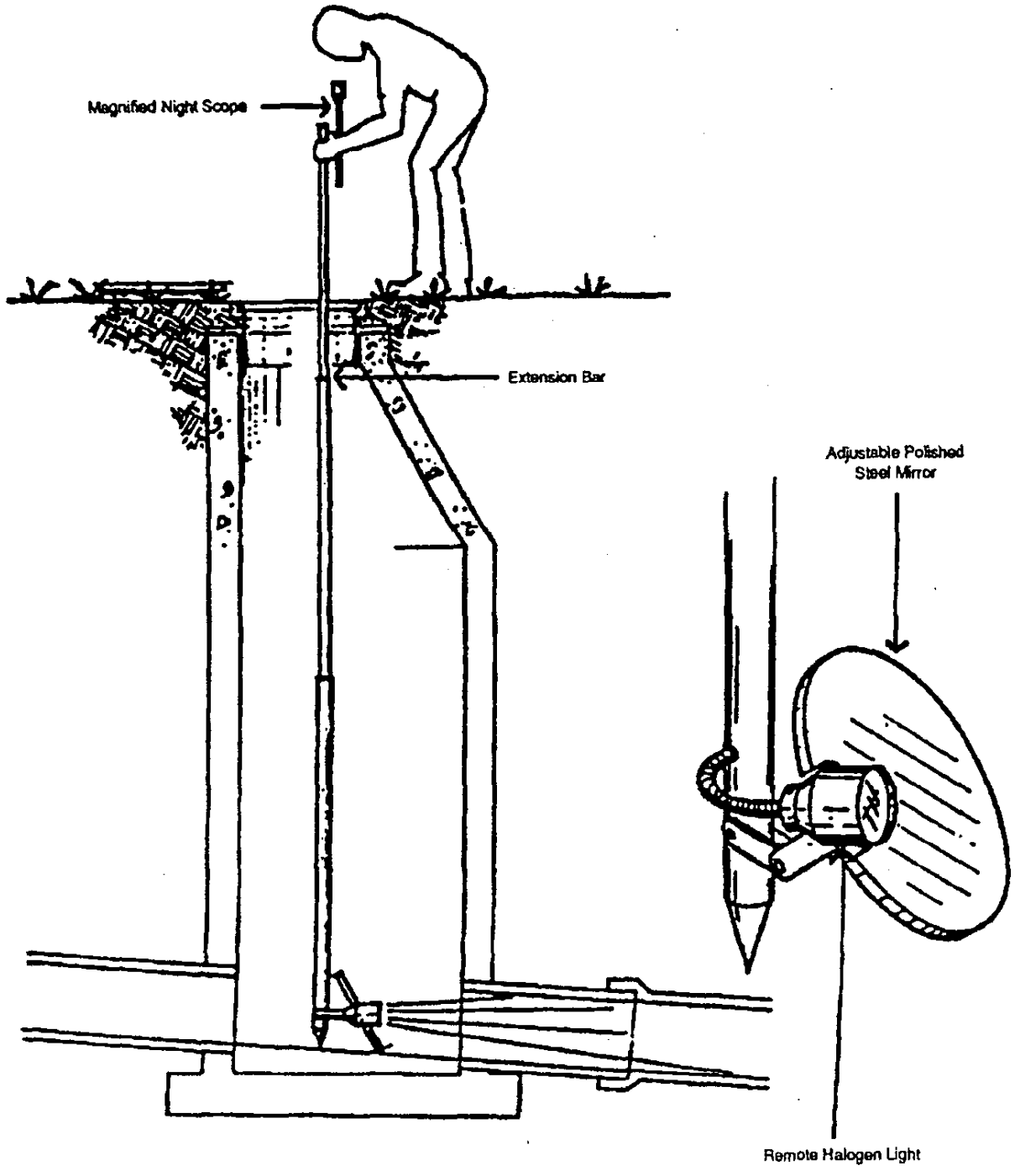


Figure 4-3. Quick method of inspecting sewer lines.



inspection and Figure 4-3 indicates a quick method of inspecting sewer lines without entering the manholes.

4.3.5 Rainfall Simulation

This task involves the identification of the sections of sewers that exhibit I/I conditions during rainfall events. Rainfall simulation does not have to be performed in every SSES. A careful study of the sewer maps and review of the I/I analysis report, smoke test results and the physical survey results indicate whether rainfall simulation is required.

4.3.6 Smoke Testing

This is an inexpensive and quick method of detecting inflow sources in sewer systems. Many inflow sources such as roof leaders, cellar, yard, and area drains; foundation drains; abandoned building sewers; faulty connections; illegal connections; sewer cross connections, structural damages and leaking joints can be identified by smoke testing under ideal conditions. Key steps for smoke testing are:

- Conduct smoke tests in selected sanitary lines (adequate notification must be made before smoke testing is done. This requires notification to residents, the local fire department, public meetings, etc.)
- Record, both in written and photographic form, all sources from which smoke emissions are noted.
- Visually inspect manholes suspected of having direct inflow connections into sanitary sewers.
- Identify direct inflow connections to sanitary sewers.
- Identify interconnections between sanitary and storm systems as evidenced by smoke emissions during the smoke test.

Smoke testing should not be conducted on sewer lines which contain sags, or are flowing full. Smoke testing cannot detect structural damage, or leaking joints in buried sewers and service connections when the soils surrounding and above the pipes are saturated, frozen or snow covered. Smoke testing should not be performed on windy days when the smoke coming out of the ground may be blown away so quickly as to escape visual detection. The following equipment is usually required to conduct smoke testing:

- Smoke bombs
- Air blowers
- Camera and film
- Sand bags and/or plugs
- Two-way radios

The smoke bombs used should be non-toxic, odorless and non-staining. An air blower is used to force the smoke into the sewer pipes. The camera is used to take pictures of the smoke coming out of the ground, catch basins, pipes and other sources during the test. Sand bags and/or plugs are used to block the sewer sections to prevent the smoke from escaping through the manholes and adjacent sewer pipes. It is important to coordinate with the fire department to prevent false alarm if for some reason the smoke would enter a house and would trigger a false alarm.

4.3.7 Dyed Water Testing

Dyed-water testing is used primarily to detect infiltration and RII sources in storm sewer sections, stream sections, and ditch sections. It can also be used to verify the results of smoke testing. This method of testing is more expensive and time consuming than smoke testing and requires large quantities of water.

Fluorescent dyes are used for this testing technique. The dyes should be safe to handle, biodegradable and inert to the soil and debris in sewers. Further information on the common types of dyes can be obtained from Reference 5.

The procedure for dyed water testing includes:

- Plug and flood with dyed water any storm sewer sections which are parallel to or cross sanitary sewers and house service lines which have shown evidence of smoke when nearby sections have been smoke tested.
- Where applicable, flood catch basins, ditches and ponding areas in close proximity to sanitary sewers with dyed water.
- The presence of dye or absence in adjacent downstream manhole indicates the infiltration potential.
- The response time of the appearance of the dye and in some cases the visual increase in flow provides additional insight into the infiltration or RII pathway.
- Analyze findings and recommend appropriate sewer sections for cleaning and internal inspection.

4.3.8 Water Flooding Test

This test is similar to dyed water testing, except that no dyes are used. With accurate flow measurement, pipe imperfections can be detected with this technique. The water flooding tests can be conducted by the following methods:

- Sprinkler test - Inflow and/or RII under unpaved areas, particularly in service connections during wet weather conditions, can be determined by the sprinkler test. Irrigation sprinkler pipes with spray nozzles are used to simulate rainfall conditions, and the rate of application of the water and the total water distributed are monitored.
- Exfiltration test - The exfiltration test is used to check the sewer lines and manholes for possible leakage.

The procedures involved in the exfiltration test are covered in Chapter 3.

4.4 Cleaning

Internal inspection of lines suspected of having I/I sources and any flow velocity measurement requires clean pipes. Debris in sewer inverts, grease accumulation and heavy root infestations not only obstruct visual or video inspection but they also may hide or mask actual infiltration sources. Preparatory cleaning is an essential first step in any meaningful internal examination procedure. The cleaning procedure should clean the sludge, mud, sand, gravel, rocks, bricks, grease and roots from the sewer pipes, manholes and pumping station wet wells to be inspected. The pipe walls should be clean enough for the camera used in the inspection to discover structural defects, misalignment and I/I sources. The following steps are required for cleaning:

- Clean all sewer lines by appropriate means and with proper equipment immediately prior to internal inspection or velocity measurement.
- Determine, if possible, all obstructions or other physical alignment, joint or connection conditions which could interfere with or prevent the insertion and movement of inspection equipment.

The equipment required for cleaning includes:[2,3]

- Rodding machines, bucket machines, high-velocity water machines and other hydraulically propelled devices
- Debris removal equipment, such as vacuum machines and trash pumps
- Debris transport vehicles
- A proper debris disposal site

For proper cleaning, factors to be considered are: access and condition of manholes, depth of sewer, size of pipe, depth and type of solid materials to be removed, degree of root intrusion, amount of flow, structural integrity of pipe, availability of hydrant water and the degree of cleanliness required. Figure 4-4 indicates some techniques involved in preparatory cleaning. Direct observation and camera are the usual forms of internal inspection equipment used for sewer lines. Direct observation is used for large lines that can be walked or crawled, while cameras are used on small-diameter sewers.

4.5 Internal Inspection

Internal inspection involves the following tasks:[3,4]

- Set up TV camera or other equipment in the sewer lines under investigation.
- Plug and flood all storm sewers in close proximity to sanitary sewers under inspection, if recommended by rainfall simulation findings.
- Internally inspect, designate footage, and note all structural defects and all leaks in terms of location and flow rates.
- If services are found to be running, verify whether the flow is caused by infiltration or actual water usage.
- Record findings on log sheets and support with video tapes.

Internal inspections can be accomplished in the following ways:[3,4]

4.5.1 TV Inspection

The TV inspection technique utilizes a closed-circuit TV camera to observe the conditions in the sewer lines. The TV cameras used are specially designed to detect the sewer conditions.

The camera is mounted in a casing and is pulled through the sewer with cables. Recently self propelled cameras have been used, but the disadvantage of this type of camera is required service and recovery if they fail or get stuck in the middle of the pipe run. The results are shown on the TV monitor and documentation can be made by a videotape or by photographs of the monitor. A light source is provided by the camera for illumination purposes.

4.5.2 Photographic Inspection

This technique utilizes a camera to take a series of color photographs along the inside of sewer lines. This technique is best for analyzing the structural conditions of the sewers. A camera is pulled through the sewer line being inspected. Pictures are taken at equidistant intervals or at some predetermined problem sections.

4.5.3 Physical Inspection

This technique involves the direct inspection of larger sewers not in service. Before inspection, the safety of the person entering the line should be carefully considered and the sewer section thoroughly ventilated to remove H_2S and other harmful gases that might be present.

Proper NIOSH-OSHA safety practices and procedures should be followed to properly carry out physical inspections.

Figure 4-5 shows the technique involved in TV inspection.

4.6 Cost Effectiveness Analysis

Figure 4-4. Preparatory cleaning.

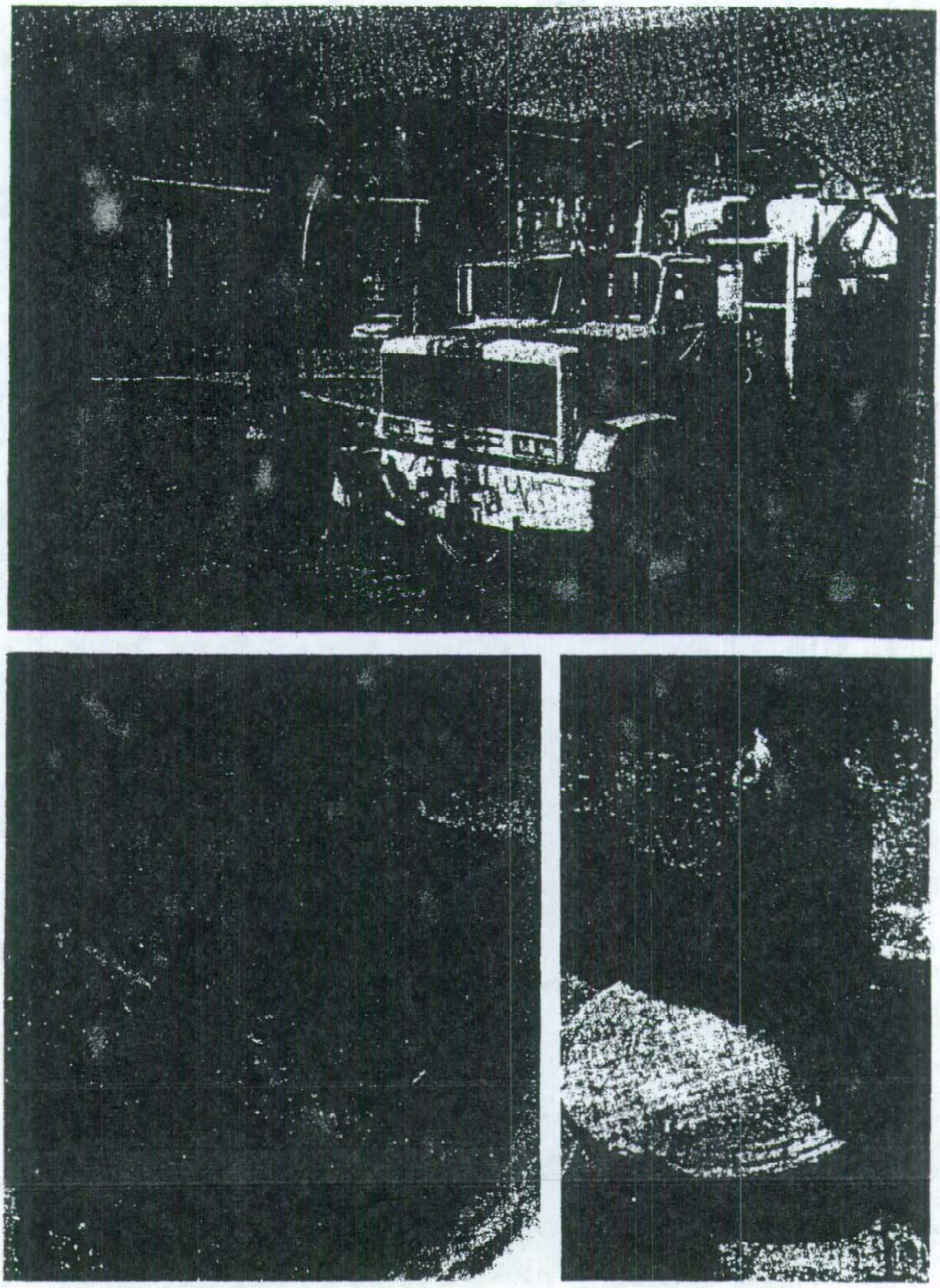
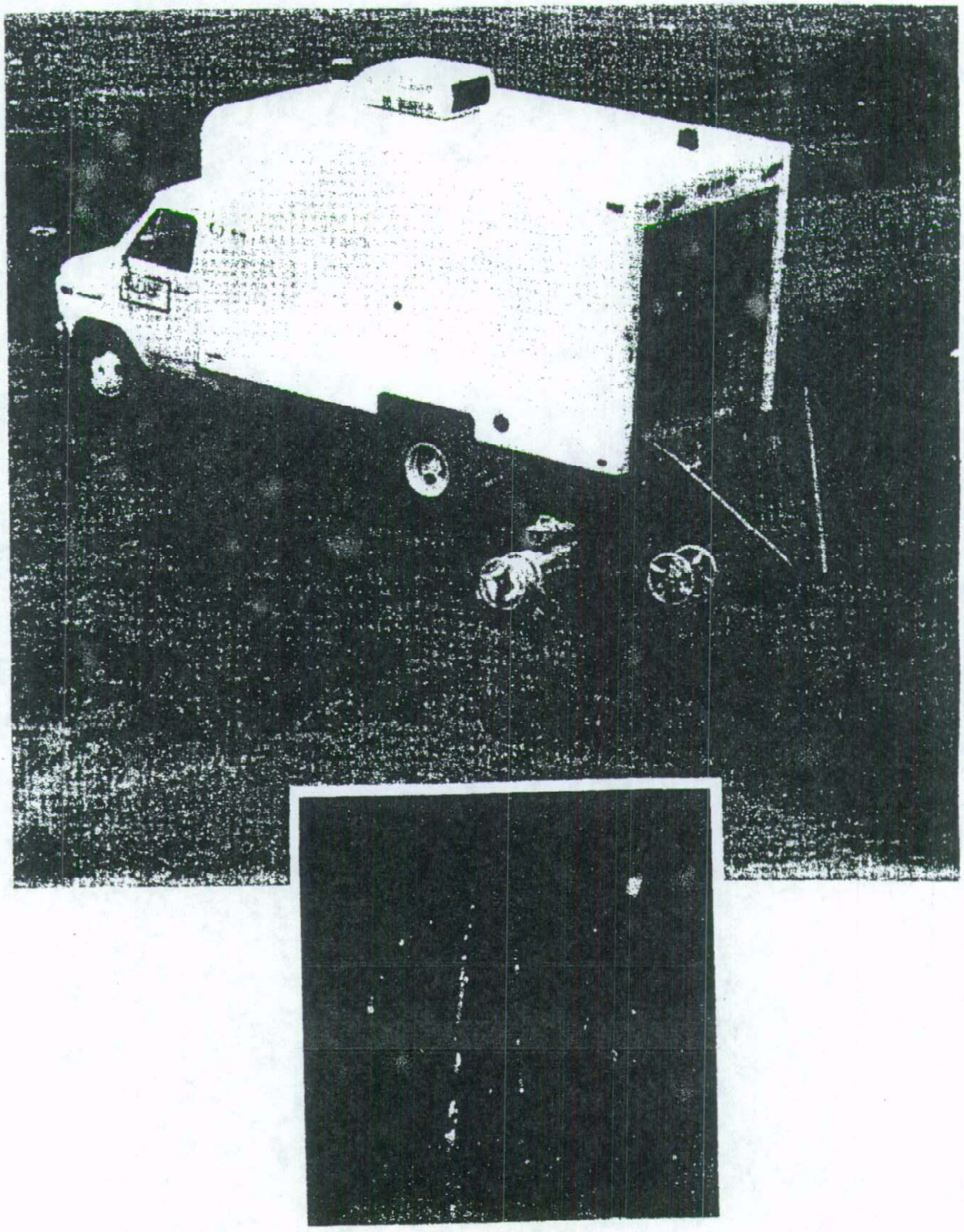


Figure 4-5. Internal color TV inspection.



Based on the results and findings of the SSES, a detailed evaluation and analysis should be carried out to determine the most cost-effective means of correcting or alleviating excessive I/I conditions found in the system.

Cost-effectiveness analysis for SSES is similar to the cost-effectiveness analyses for I/I. However, the SSES cost-effectiveness analysis provides a detailed and thorough analysis of the sewer system including the flow rates from each source, and the best method for rehabilitation of each source. For an effective cost analysis, the cost of correction for infiltration, inflow, RII and groundwater migration must be considered. Existing SSES methodologies rely on individual line segment nighttime isolation and measurements to identify excessive infiltration.

Subarea SSES analysis including migration effects is an improved approach to the traditional point source approach for evaluating sewer systems. (See Section 4.7 for a description of the subarea approach to rehabilitation). Flow adjustments for infiltration should be carried out before the cost-effectiveness analysis is conducted.[2]

Costs for the evaluation survey should be based on the total actual expenditure for the survey. Costs for rehabilitation should be based on the actual physical conditions discovered. The costs for transportation and treatment of wastewater should then be developed for at least four typical flow conditions so that a cost curve can be drawn to indicate the general cost pattern.[3]

A cost summary similar to that shown in Table 4-2 can be prepared to summarize the overall cost of a sewer system evaluation and rehabilitation program. The presentation of the costs for Infiltration and Inflow must be separately developed. The general procedures outlined below should be followed to develop both infiltration and Inflow costs in a format for the cost effectiveness analysis curve preparation:

- Determine the total correction cost for each Infiltration and Inflow source and calculate the cost required for eliminating each unit of flow.
- Arrange the costs in a descending order with lower costs ahead of the higher costs.
- Arrange the costs in groups and determine the total correction cost for each group. Add costs for engineering services, administrative costs, contingency costs, interest during construction, etc. to derive the total required cost to eliminate the I/I from all sources within each group.
- Calculate the total accumulative cost (Curve B of Figures 4-6 and 4-7) against the total accumulative infiltration and inflow separately to be reduced and draw a curve passing through all data points. Plot a curve showing the relationship between the cost of transportation and treatment and the total infiltration and inflow (separate) to be reduced (Curve A). Derive a composite cost curve (Curve C) by adding the costs of each of the two derived curves (curves A and B). Locate the minimum cost point on the composite curve, and draw a straight line passing this point and parallel to the cost axis. The line intercepts the cost curve for infiltration and rehabilitation (Figure 4-6) and inflow rehabilitation (Figure 4-7) at a point which represents the optimal point for sewer rehabilitation. The flow figure corresponding to these points on each curve represents the infiltration or inflow which can be cost-effectively removed from the sewer system, and the cost figure corresponding to this represents the total cost which will be needed for the corrective actions.

4.7 Case Study Example and Detailed Method of Analysis

This section outlines a detailed method of analysis for SSES taking into account migration and rainfall-induced-infiltration. This detailed analysis was performed by the WSSC to develop a new approach to sewer system evaluation and rehabilitation known as the System Approach to evaluate Subarea Rehabilitation (SASR).[4] The subarea approach represents a large area (6,000-30,000 lineal m [20,000-100,000 lineal ft] of sewer) undergoing a sewer system evaluation survey as opposed to the traditional method of evaluating smaller segments and single sources. Field activities incorporated in this study included the following:

Rainfall Monitoring - Monitoring was conducted by four continuous recording gauges to measure precipitation to 1/100th of an inch versus time, to allow for correlation of inflow to rainfall intensity.

Continuous Flow Monitoring - This was performed at each subarea outlet utilizing flow meters to record depth and velocity.

Internal Night-Time Flow Measurements - Flow measurements conducted within each subarea to identify mini-systems subject to infiltration.

Manhole and Visual Pipe Inspections - Inspection for each manhole began at the surface by identifying potential for ponding and concluded with evaluation of the condition of the bench and trough, and lamping of connecting pipes.

Table 4-2. Cost Summary for SSES and Sewer Rehabilitation[1]

Description	Est. Quantity: Quantity	Est. Quantity: Unit	Estimated Cost: $/Unit	Estimated Cost: Total
SEWER SYSTEM EVALUATION SURVEY				
1. PHYSICAL SURVEY				
Above Ground Inspection	____	manhour	____	____
Flow Monitoring	____	manhour	____	____
Manhole and sewer inspection	____	ft (m)	____	____
Subtotal				____
2. RAINFALL SIMULATION				
Smoke Testing	____	ft (m)	____	____
Dyed Water Testing	____	ft (m)	____	____
Water Flooding Tests	____	ft (m)	____	____
Subtotal				____
3. PHYSICAL SURVEY REPORT	____	manhour	____	____
4. PREPARATORY CLEANING	____	ft (m)	____	____
5. INTERNAL INSPECTION	____	ft (m)	____	____
6. ENGINEERING	____	manhour	____	____
7. OTHERS	____			
TOTAL SSES COSTS				____
SEWER SYSTEM REHABILITATION				
• CORRECTION FOR INFILTRATION				
1. SEWER EXCAVATE AND REPLACE	____	ft (m)	____	____
2. CHEMICAL GROUTING	____	ft (m) Lump	____	____
3. SLIPLINING OR INSERTION	____	ft (m)	____	____
4. CURED-IN-PLACE INVERSION LINING	____	ft (m)	____	____
5. SPECIALTY CONCRETE	____	ft (m) or Lump	____	____
6. LINERS	____	ft (m) or Lump	____	____
7. COATINGS	____	ft (m) or Lump	____	____
8. MANHOLE WET WELL REPLACEMENT	____	Lump	____	____
9. MANHOLE WET WELL REPAIR	____	Lump	____	____
10. FAULTY TAPS REPAIR	____	Lump	____	____
11. HOUSE SERVICE PIPE REPLACEMENT	____	ft (m) or Lump	____	____
12. HOUSE SERVICE PIPE REPAIR	____	ft (m) or Lump	____	____
• CORRECTION FOR INFLOW				
1. LOW LYING MANHOLE RAISING	____	Lump	____	____
2. MANHOLE COVER REPLACEMENT	____	Lump	____	____
3. CROSS CONNECTION PLUGGING	____	Lump	____	____
4. ROOF LEADER DRAIN DISCONNECTION	____	Lump	____	____
5. FOUNDATION DRAIN DISCONNECTION	____	Lump	____	____
6. CELLAR DRAIN DISCONNECTION	____	Lump	____	____
7. YARD DRAIN DISCONNECTION	____	Lump	____	____
8. AREA DRAIN DISCONNECTION	____	Lump	____	____
9. COOLING WATER DISCHARGE DISCONNECTION	____	Lump	____	____
10. DRAINS FROM SPRINGS AND SWAMPY AREAS TO BE PLUGGED	____	Lump	____	____
• OTHERS				
1. ENGINEERING SERVICES	____	Lump or Manhours	____	____
2. LEGAL AND ADMINISTRATIVE SERVICES	____	Lump	____	____
3. CONTINGENCY	____	Percent	____	____
4. INTEREST DURING CONSTRUCTION	____	Percent	____	____
5. SALVAGE VALUE	____	Lump	____	____
TOTAL REHABILITATION COST				____

Figure 4-6. Cost-effectiveness analysis curve for infiltraion.

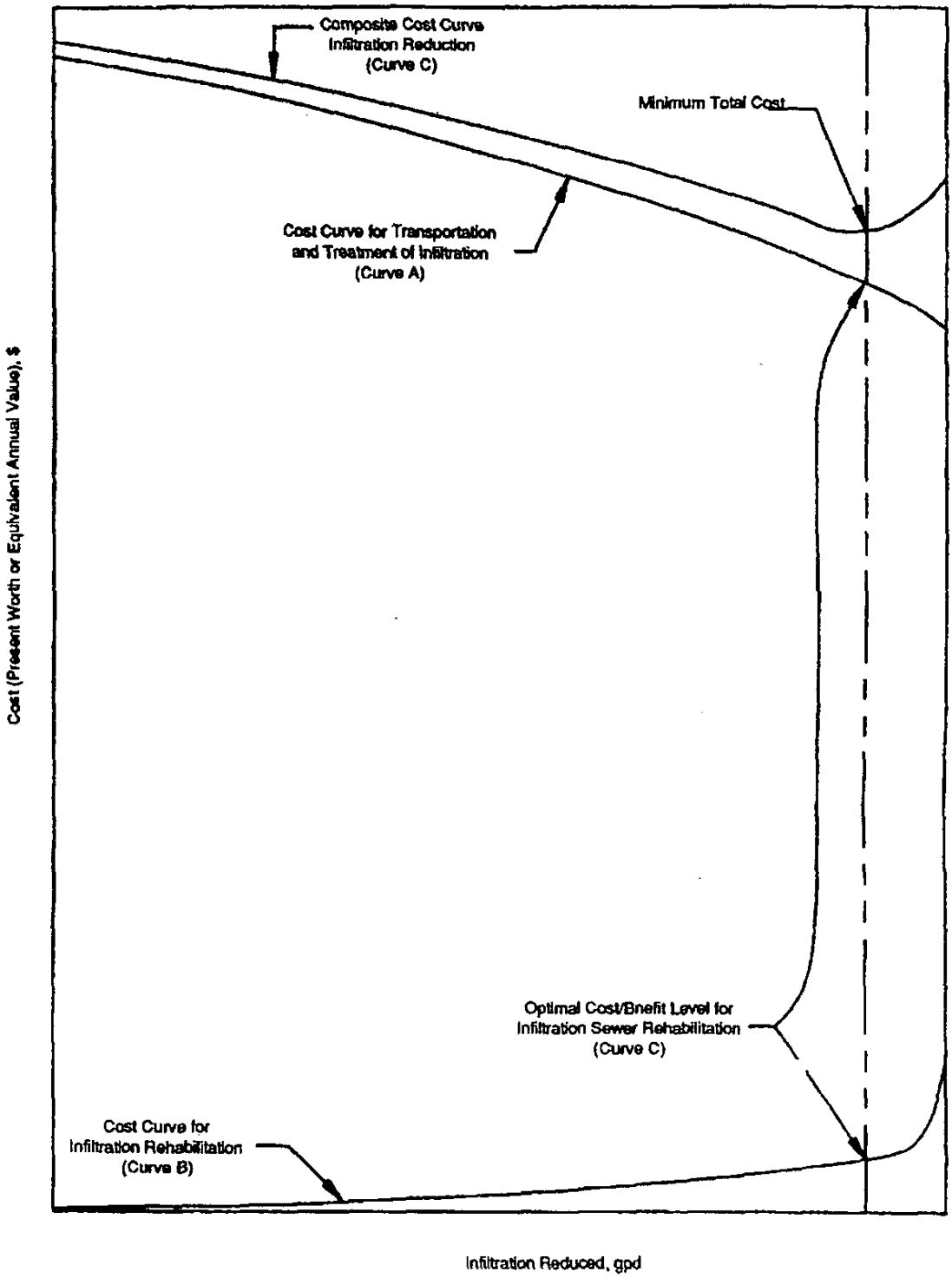
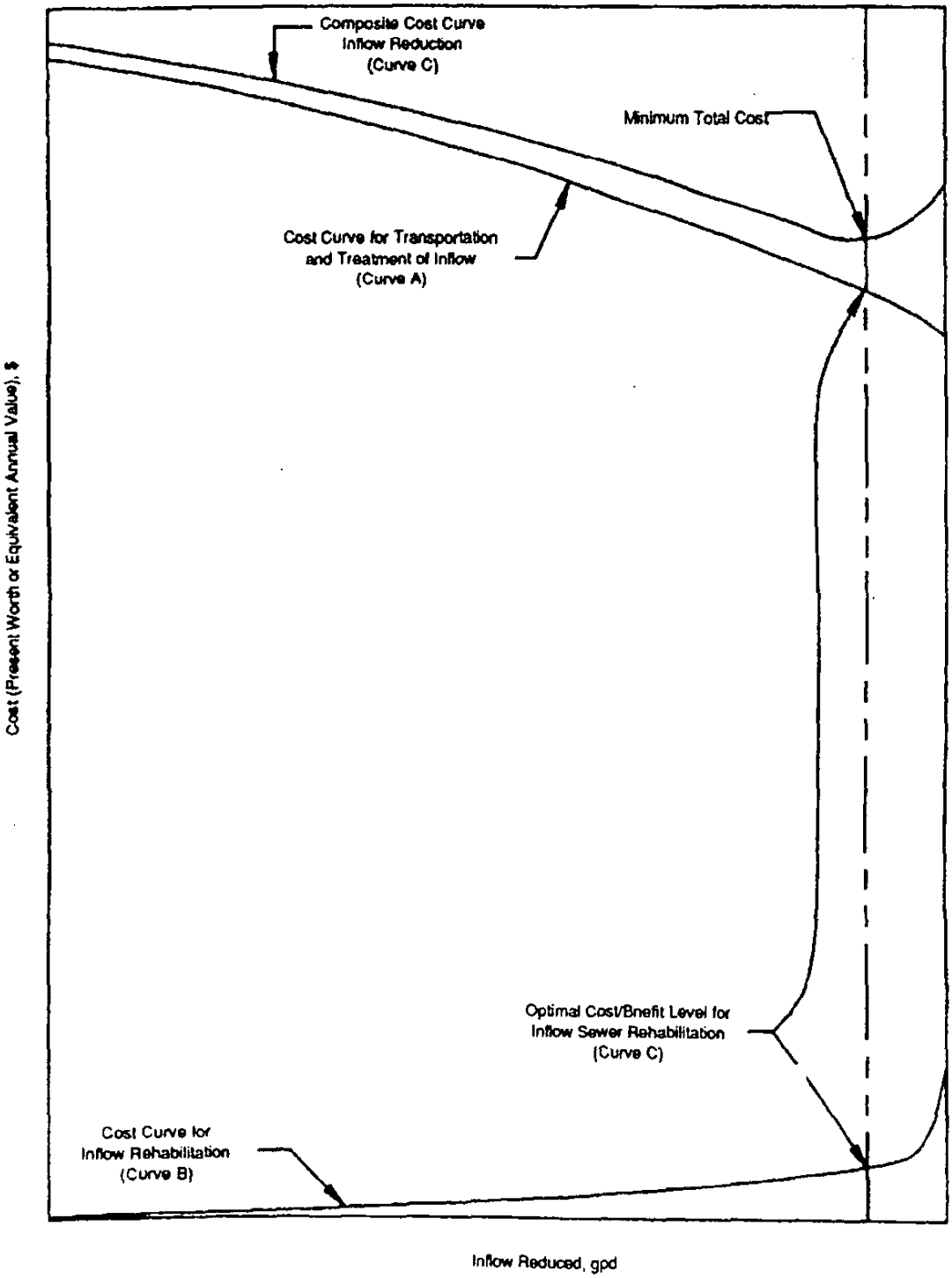


Figure 4-7. **Cost-effectiveness analysis curve for inflow.**



Smoke Testing - Performed with an intensive technique requiring isolation of each segment by blocking flow and injecting smoke using blowers, one on each of two adjacent manholes.

Dyed Water Flooding - Inflow sources identified during smoke testing were quantified by the dyed water flooding technique.

TV Inspection - As a result of nighttime flow measurements, certain sewers were identified for TV inspection.

Building Inspections - This consisted primarily of determining inflow connections to the service laterals, such as storm and combination sump pumps, and external drains such as areaway and roof drains.

The total of the assigned flows from all of the identified inflow sources was then compared to and balanced with the measured flow of each subarea at a 1-yr storm event. Inflow at a 1 year storm event was determined by linear regression of moderate storms, when the system was not in a hydraulically restricted or surcharged state. Infiltration sources were quantified and monitored at the outlet flow meters. Quantification of inflow and infiltration obtained during the subarea evaluation is presented in Table 4-3.

A cost-effectiveness analysis for the WSSC example was performed on a subarea basis incorporating the effects of migration, capital cost of treatment, O&M cost for treatment, cost of relief lines, and cost of rehabilitation. As a result of the analysis, clustered rehabilitation was recommended by subarea. This type of rehabilitation minimizes the migration effect. Also, the effectiveness of rehabilitation can be measured more rapidly because flow reduction is concentrated instead of dispersed over a wide area. I/I rehabilitation was then recommended for the entire subarea

A summary of the cost effective analysis for the subarea is presented in Table 4-4. Anticipated flow reductions after implementation of the recommended rehabilitation provides the estimated unit construction cost ($/gpd). Finally, a comparison of point-source rehabilitation with the sub-system approach was performed for each method and is presented in Table 4-5.

The point-source analysis initially resulted in a unit rehabilitation cost of $0.25/L/d ($0.95/gpd), but by incorporating the effect of migration, less infiltration would actually be removed, thus resulting in an actual

Table 4-3. **Quantification of I/I Through the Subarea System Approach for the Washington Suburban Sanitary Commission[4] (Reprinted with Permission from Water Engineering and Management**

Source	Flow (mgd)	Percent of Total
INFLOW		
Public Sector Inflow		
Manhole Defects		
Cover/rim leaks, ponding(1)	0.020	0.8
Frame seals	0.261	10.1
Corbels and broken frames	0.078	3.0
Cross connections	0.026	1.0
Subtotal	0.385	14.9
Private Sector Inflow		
Downspouts	0.288	11.2
Area-wide drains	0.539	20.9
Foundation drain connection	0.011	0.4
Suspect foundation drain connection	0.773	30.0
Defective lateral clean outs	0.009	0.3
Suspect defective service laterals	0.364	14.0
Storm sump pump connection	0.212	8.2
Subtotal	2.196	85.1
Total	2.581	100.0
INFILTRATION		
Manhole Defects		
Cracked/defective walls	0.039	4.2
Defective pipe seals	0.024	2.6
Bench/trough leaks	0.004	0.4
Pipe Defects		
Groutable defective joints/pipes	0.387	41.5
Non-groutable defective pipes and groutable service connection	0.34	36.6
Infiltration in line segments and manholes not inspected	0.137	14.7
Total	0.932	100.0

Table 4-4. **Cost-Effective Analysis for I/I Reduction for the Washington Suburban Sanitary Commission[4] (Reprinted with Permission from Water Engineering and Management)**

SUMMARY OF RECOMMENDED PLAN

Rehabilitation Item	Estimated Quantity	Estimated Construction Cost, $ (1986)
Inflow		
Manhole cover/frame replacement	38	17,710
Manhole frame seals/raising	121	96,800
Manholes corbel	16	9,900
Cross-connection	1	4,000
Subtotal		127,800
Infiltration		
Manhole walls, pipe seals, bench/trough	22	14,996
Relining/replacement	20	386,015
Line grouting	27	20,082
Pipe replacement	7	35,000
Connection grouting, lateral repair	25	45,000
Subtotal		501,091
Total		628,891

ESTIMATED FLOW REDUCTION

Source Type	Estimated Flow Reduction, mgd (1986)	Estimated Construction Cost, $/gpd (1986)
Inflow	0.385	$0.33
Infiltration	0.297	$1.69

Table 4-5. **Cost-Effective Analysis by Point Source for I/I Reduction for the Washington Suburban Sanitary Commission[4] (Reprinted with Permission from Water Engineering and Management)**

Approach	Removable Infiltration, mgd	Rehabilitation Costs Total $	Rehabilitation Costs $/gpd
Point Source Approach			
Assumed without migration	0.164	$156,000	0.95
Estimated, with migration	0.081	$156,000	1.93
Sub System Approach	0.143	$238,000	1.66

unit rehabilitation cost of $0.51/L/d ($1.93/gpd). I/I cost effective analysis utilizing the subarea approach was found to be $0.44/L/d ($1.66/gpd).[4]

4.8 References

When an NTIS number is cited in a reference, that reference is available from:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

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Citation Search Result Rank 10 of 10 Database
La. Atty. Gen. Op. No. 00-14 LA-AG
La. Atty. Gen. Op. No. 00-14, 2000 WL 1132726 (La.A.G.)
(Cite as: 2000 WL 1132726 (La.A.G.))

Office of the Attorney General
State of Louisiana
***1** Opinion No. **00-14**
July 5, 2000

90-A-2 PUBLIC FUNDS - Loan, Pledge or Grants

Even though City-Parish of East Baton Rouge is obligated to the EPA to reduce sewer discharge, it can not publicly found the repair of sewer lines located on private property. Recalls Op. 92-575.

Mr. Michael E. Ponder
Parish Attorney
Parish of East Baton Rouge
P.O. Box 1471
Baton Rouge, Louisiana 70821

Dear Mr. Ponder:

Reference is made to your request for an opinion of this office regarding potential improvements to private sewer service lines at the expense of the City-Parish of East Baton Rouge.

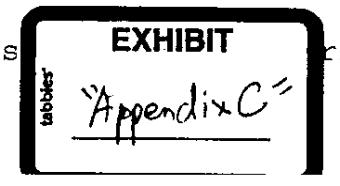
According to your correspondence, the City-Parish has been required by the Environmental Protection Agency ("EPA") to substantially reduce sewer discharge. In conjunction with a consent decree between the City-Parish and the EPA, the City-Parish is undertaking a pilot program to correct all leaks in the main sewer collection lines, and the lateral and service lines in a particular geographic area. You further advise that the project requires that all leaks in said lines must be repaired within a limited time frame.

As noted in your letter:

"The City-Parish currently has the authority to require the property owner to make any necessary repairs to sewer lines on their property under penalty of fines and/or jail. In the event of an immediate threat to the public health, safety and welfare, the City-Parish also has the authority to make the necessary repairs and place a lien on the property to recover any associated costs. The City-Parish also has the authority under the provisions of L.S.A. RS 33:3981 and 3996 to construct a new system and pay all or a portion of the costs."

However, even though the City-Parish has such authority, you have requested our opinion as to whether the City-Parish can make the necessary repairs to sewer lines that are on private property and absorb all or some of the repair costs. Specifically, you ask this office to examine whether the provisions of La. Const. Art. VII, Sec. 14 are violated if the City makes the repairs without seeking to recover the cost of repairs made on private property, in light of the fact that the City-Parish has a legal duty, under its consent decree with the EPA, to conduct the pilot program.

As you are no doubt aware, La. Const. Art. VII, Sec. 14 generally prohibits the state and its political subdivisions from loaning, pledging, or donating public funds, credit, property, or things of value to or for any person, association or corporation, public or private. The Supreme Court has interpreted Art. VII, Sec. 14 to be violated whenever the state or a political subdivision seeks to give up



something of value when it is under no legal obligation to do so. City of Port Allen v. Louisiana Municipal Risk Agency, 439 So.2d 399 (La. 1983).

This office has construed the "legal obligation" requirement referred to in the City of Port Allen decision to be a requirement that the purpose of and power for a particular expenditure of public funds be "sanctioned", or "authorized by law", or in the "discharge of a legal duty". Op. Atty. Gen. No. 92-204. See also: Guste v. Nicholls College Foundation, 564 So. 2d 682 (La. 1990). The opinions of this office also refer to the requirement of "an underlying legal obligation or authority" for the transfer of public funds. Op. Atty. Gen. Nos. 92-543, 92-494, 92-402, 92-204.

***2** There can be no question but that the City-Parish of East Baton Rouge has no general obligation or authority to individual property owners or citizens to expend public funds to improve or repair the sewer lines located on their private property. Therefore, the issue that this office must address is whether the City-Parish's agreement with the EPA provides sufficient legal obligation or authority for the City-Parish to make repairs to private sewer lines.

Respectfully, we must advise that in our opinion the City-Parish may not assume the cost of sewer line repairs to lines located on private property, as the assumption of those costs would be tantamount to a donation. In accord: Op. Atty. Gen. Nos. 98-432, 97-99, 96-348, 90-498, 78-1562. By virtue of the City-Parish's authority to compel private property owners to make necessary repairs, the City-Parish is not required or obligated to fund the repairs with public money. Although the City-Parish is obligated to the EPA to reduce sewer discharge, it can apparently accomplish what needs to be done on private property by requiring necessary repairs to be made by the property owners. Since the City-Parish has the authority to require private property owners to make sewer repairs, the need for the City-Parish to publicly fund the repairs is obviated. In accord: Op. Atty. Gen. No. 98-432, 97-99, 93-789.

Please note that La. Const. Art. VII, Sec. 14(B) contains an exception to the general rule of Art. VII, Sec. 14 in that the donation of public funds is permissible for programs of social welfare for the aid and support of the needy. Art. VII, Sec 14(B) has been construed to include the use of public property as well as funds for social welfare purposes. Op. Atty. Gen. Nos. 98-432, 98-238, 97-236, 87-587, 84-161. Therefore, in our opinion, the City-Parish could, in accordance with Art. VII, Sec. 14(B), fund sewer line repairs located on private property if the public funds are utilized for those who can be classified as needy and if those who receive assistance are screened through objective criteria to ensure that they are truly needy. In Accord: Op. Atty. Gen. No. 98-432.

It is also our opinion that the City-Parish is not prohibited from undertaking the repair of sewer lines located on private property as long as the City-Parish charges each landowner a fee that is sufficient to defray the cost of the repairs. Op. Atty. Gen. Nos. 98-432, 97-99, 95-221.

As your letter indicated, Op. Atty. Gen. No. 92-575 provides that a municipality could undertake the cost of paint and repair to private property for purposes of municipal beautification. However, that opinion is in direct conflict with a number of other opinions issued by this office, to-wit: Op. Atty. Gen. Nos. 99-166, 94-518A, 94-518, 92-780, 92-402. Op. Atty. Gen. No. 92-575 is hereby recalled.

We trust the foregoing to be responsive to your request. Please do not hesitate to contact this office if we can be of assistance in other areas of the law.
Yours very truly,
***3** Richard P. Ieyoub
Attorney General
Jeanne-Marie Zeringue Barham
Assistant Attorney General
La. Atty. Gen. Op. No. 00-14, 2000 WL 1132726 (La.A.G.)
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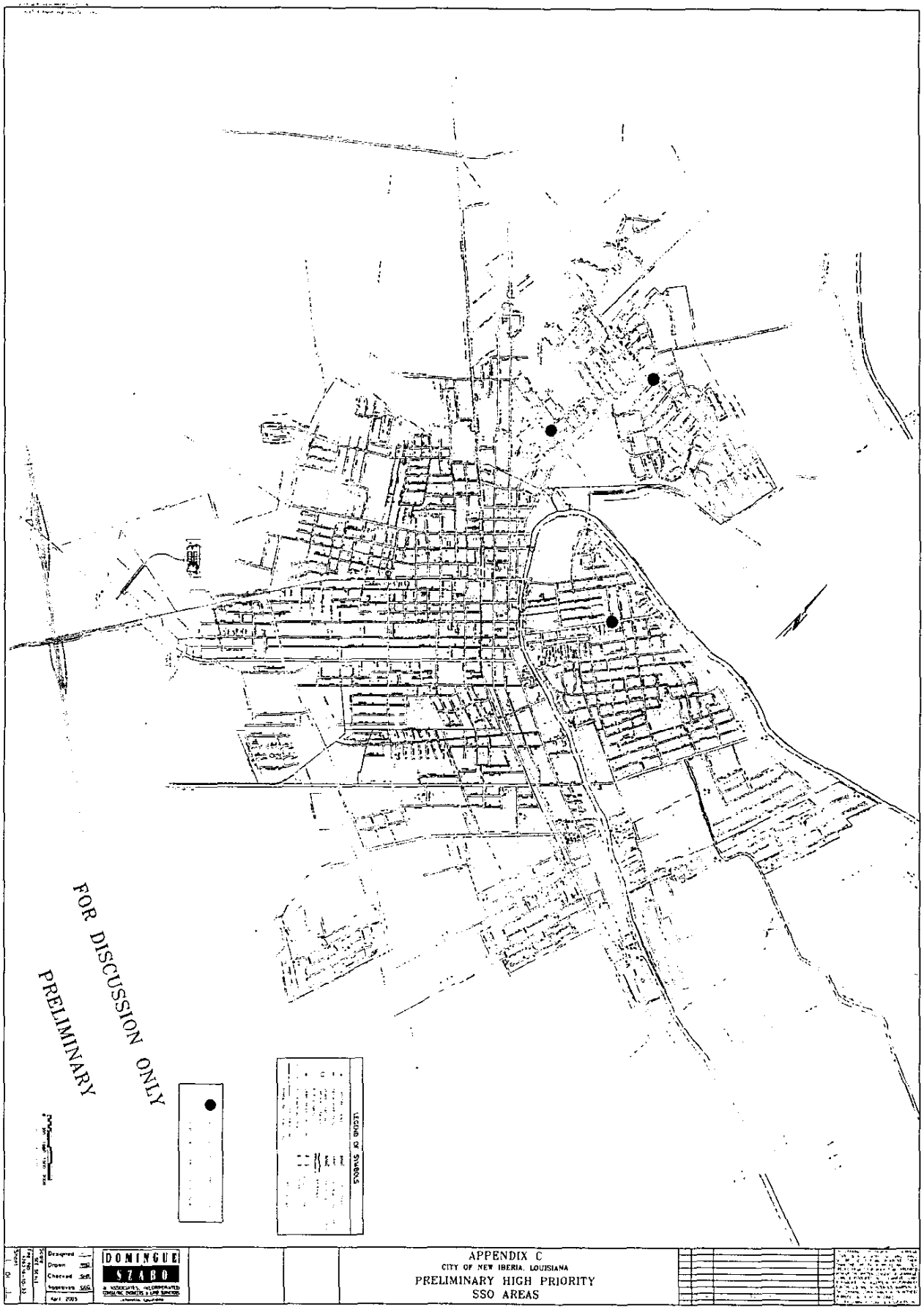

APPENDIX C
CITY OF NEW IBERIA, LOUISIANA
PRELIMINARY HIGH PRIORITY
SSO AREAS

DOMINGUE SZABO

EXHIBIT

tabbies "Appendix D"